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Conspiracy of a Trust

This week we report the result of the trial of the defendants in the well-known "bathtub" case on the conspiracy charge under the criminal section of the Sherman act, resulting in fines which totaled $51,007. This outcome of the case, although not final in the event that the defendants take an appeal, will undoubtedly be effective in restraining attempts at circumvention of the anti-trust laws under the protection of an interpretation of the patent statutes at best doubtful and now dangerous. To the legal mind the case was settled by the action of the Supreme Court, but popular respect for the decision is vastly increased by a subsequent verdict of guilt from a jury which tried the defendants on the criminal charges. The outcome of this case, coupled with the agreed decree entered at Detroit on Feb. 7 dissolving the so-called boot and shoe last trust, tends to establish the principle that patents, while permitting numerous restrictions on patented articles themselves, cannot be extended to confer upon unpatented articles privileges which would normally or otherwise be unlawful. And yet, because no two cases are ever exactly alike, there must always be certain elements of doubt in almost every new case arising, which probably invite litigation that would not be thought of under statutes which adequately covered the situation.

Display and Real Service

The central-station company which is endeavoring to hold the regard and good will of its customers and its public can make no more serious tactical mistake than that of installing a business office or building equipped to a degree of impressiveness or luxury that arouses local suspicion concerning the profitable character of utility service. With praiseworthy zeal and progressiveness of spirit, a number of the larger companies have lately erected monumental and beautiful structures—genuine ornaments to the community—which should be the cause for the greatest civic pride. In the same spirit, utilities in smaller places have vied with each other in installing mahogany fittings, marble counters and other evidences of material prosperity that would do credit to a city bank. These fine touches are not, of course, really extravagant when regarded as a percentage charge on the other heavy investments of the utility business. But to the customer who thinks he is being overcharged for his few kilowatt-hours per month, or to the disgruntled patron with a "kick," the effect of such grandeur can be only to arouse further enmity and to put off indefinitely the winning of a friend of whom the company stands in bad need. To the man with a grievance marble columns and onyx counters can have no other meaning than inflated rates and unjust charges. The discontent thus bred is sure to be disseminated in the community and to hurt the corporation. Public sentiment is an asset more vitally material and priceless than any marble front. Whereas a bank gains prestige and confidence from impressive quarters, the utility which is endeavoring to serve the public at a reasonable return can expect only distrust and suspicion to result if it makes needless display. Seldom does popularity prevail where architecture and interior decoration have received more attention than is accorded to those intangible structures of public opinion on which final success really rests. Certain modern managers in close touch with the spirit of the times have been ready to admit that the splendid shells which house their offices are after all liabilities instead of assets when it comes to holding or recovering public sentiment. The central station is expected, as a matter of self-respect, of course, to occupy dignified and attractive quarters, but care must be taken, lest more vital interests be encroached upon, that the standard it adopts be not too far above the local scale prevailing among similar places of business of the rank and file of its friends and customers on whom it depends.

Co-operation of Associations

To characterize it as an epochal event is merely to do justice to the meeting in New York this week of the public policy committees of the National Electric Light Association and the American Electric Railway Association, when subjects of mutual interest and importance to the two great electrical industries were taken up and discussed with every manifestation of good fellowship. The results of such a conference can hardly fail to be significant and far-reaching, for while the two industries have had very little of clash and conflict during their period of wonderful parallel growth, they have more and more in common as the years go by in their dealings with the questions which affect their relations with the employee, the public and the investor, and more particularly the public service commissions, without which no modern commonwealth regards itself as up to date. Our report of the meeting shows that the two committees and their colleagues whom they took into council with them on Tuesday night represent what is best and most progressive in the leadership of the two industries. It seems rather remarkable, now that the two associations have got together on questions of public policy for the common good, that they did not do this some time ago as they have done in many other useful lines of work. But, while there has been nothing definite, such as the plan of co-operation adopted this week, the very fact that the two industries are often interlaced and interlocked in one company or system has given the two associations a personnel which is in reality often interchangeable, so that before the idea was put into formal expression or action a joint policy may

be said to have developed. Such evidences as this of solidarity in the great electrical field are to be welcomed, and we can only express the hope that the co-operative committee, which undoubtedly will be an active one, will devote its attention energetically to the many problems which lie within the relations of public utilities to the investor, the employee and the general public. Just now the legislatures of many states are giving consideration to public-utility measures, and at this psychological moment the work of the National Civic Federation can be made doubly effective if backed up by the weight of the combined public policy committees, it being presumed, of course, that the various interests involved agree on the model utility bill. There is also a tendency on the part of some railway companies possessing surplus energy to enter the lighting field, notwithstanding that the consensus of opinion among railway engineers and economists is that the generation of energy is the province of the central-station company and the transportation of passengers and freight that of the railway company. Here again the joint committee might do excellent work in conserving investments and enabling the two parties at interest to share in the joint economies resulting from a proper appreciation of the field of both. We believe that public utilities are being carried on with higher ideals and loftier principles and purposes than ever before in their history, inviting to their management the great administrative and constructive spirits of the country; but the corporations as such are still misunderstood in many ways by the public, for lack of real information about them. We cannot imagine any better task for a committee bearing the name of "public policy" than to do its best to bring about an era of good feeling between a public which deserves the very best service it can get and the utilities trying to give the very best service that is possible.

Patent-Law License Restrictions

The agreed decree which was filed by Judge Tuttle at Detroit in the shoe-last case may be regarded as an echo of the recent bathtub case decided by the Supreme Court. Here apparently was a going trust under a highly perfected scheme of license agreements which could only be defended under a construction of the patent laws which the bathtub decision had set aside. There remained apparently no alternative, in a case of this kind where the protection of the patent was not in question, but to dissolve, and this was done under an agreed decree, instead of permitting the case to take its course. This victory for the standard bearers of patent reform, such as it is, does not add much to the record. Of course the foes of reform will rush to the front with renewed declarations that there is nothing the matter—that the present laws are entirely adequate to cope with such abuses as they reluctantly concede to exist. The answer to that, however, is contained in the fact that such relief as now emerges from the decisions of the federal courts from time to time in the anti-trust cases is judge-made law, built up piecemeal from decision to decision, and no one can positively tell in advance what the outcome in any specific case will be. What we need is revision of the fundamental law, with its scope and intent clearly worded. Public opinion against the form of monopoly typified in this particular case is undoubtedly strong, but the difficulty in relying upon such precedents as have already been created is found in the endless combinations of circumstances which make each case at least a little different from any other, and thus cloud the outcome with doubt.

Compromises in Transformer Design

A brief paper by Messrs. George A. Thornton and George Goldman in the current issue gives an instructive view of the methods that can be used with transformers of approximately standard design in the way of adapting them to operating at the two usual frequencies of 25 cycles and 60 cycles per second. The paper details the results of some very practical experiments on the efficiency and heating of large transformers operated at both frequencies, both self-cooled and water-cooled. Of course, the general effects of changed frequency in transformer design are well known, and the question involved is one of facts rather than theory as to whether with suitable re-connection of the coils a transformer can be operated with reasonable success at either frequency.

The experiments recorded show that within limits a given structure can be operated at both 25 cycles and 60 cycles with a much greater degree of success than one would at first think. The copper loss is greater at the low frequency than at the high, while the iron loss is less. The permissible output, other things being equal, is, of course, greatly changed with the frequency and also with the method of cooling adopted, so that the same piece of apparatus might be a 500-kw unit when self-cooled at 25 cycles and a 1500-kw unit when water-cooled at 60 cycles. In fact, one of the striking things demonstrated by the experiments is the great advantage of water cooling as regards both actually getting high output and improving the efficiency curve. The data on the whole are more instructive from the standpoint of methods of cooling employed than with respect to the change in frequency. Whether it would pay manufacturers to go deliberately into the interchangeable-frequency line of work is another matter. Good results can be attained, as the authors plainly show, yet it remains a somewhat dubious question as to whether a little specialization will not yield enough return in the way of lessened heating and better efficiency to pay for itself as against a standard construction capable of doing fairly well at both frequencies. As a rule, experiments in operating inductive apparatus under widely varying conditions have not turned out particularly well. We recall the time when an attempt was made to work at 60 cycles transformers designed for about double that frequency, all in behalf of an economical standardization, and we also recall the rapidity with which such transformers burned out. The present, of course, is an entirely different situation, and there is no reason why transformers, even if deliberately designed to do their best work at either 25 or 60 cycles, cannot be re-connected so as to do well at the other frequency; but the difference in frequency strikes one offhand as being a little too large to cover by a compromise in general service. The subject, however, is one worth following up experimentally and we hope to hear more of it later.

The Resistance of Carbon Contacts

Carbon is employed in two electrical devices of widely extended use. One is the carbon-filament incandescent lamp and the other the carbon-microphone telephone transmitter. The carbon filament led to the solution of the problem of incandescent lighting; but the tungsten filament is so rapidly displacing its earlier prototype that we may expect, in a few years' time, to find carbon-filament lamps only in historical museums. The resistance of a carbon filament or prism falls with temperature, as is well known, instead of rising, as in the case of metals. .

In the carbon microphone we find the application of another remarkable property of carbon, namely, the variability of resistance in its surface contact under variations of contact pressure, as discovered by Hughes and Edison. The full sensitiveness of the carbon microphone is, designedly, never displayed in the telephone transmitter, partly because the highest degrees of sensitiveness are associated with both electrical and mechanical instability. A sensitively adjusted carbon microphone, however, can occasionally be made to reproduce in the telephone the footfalls of a common housefly over a soundboard so loudly as to suggest the running of a dog, and the tick of a watch can be made to sound like the throbbing of a small engine. Specially prepared carbon and delicately adjusted contacts are, however, needed for the development of such powerful sound magnifications, as the original publications on the behavior of the carbon microphone attest. Edison produced what he called a "micro-tasimeter," consisting of a carbon microphone placed in a Wheatstone bridge and delicately pressed upon by a strip of sensitive fiber. A very minute change in the length of the strip would thus give rise to a marked deflection of the bridge galvanometer. By this device a small change in the temperature or moisture of the air could easily be discovered, and even alcohol in the breath might sometimes be detected most shrewdly at a little distance.

The change in contact resistance under change of contact pressure received ample investigation in connection with the telephone transmitter. More recently, however, certain changes of contact resistance with time have been investigated by Mr. A. L. Clark and published in the *Physical Review*, as mentioned in this week's *Digest*. It seems that when a small voltage is applied steadily to a carbon-carbon contact, under light but uniform contact pressure, the resistance of the contact tends to fall in a regular manner for a little while. This diminution in contact resistance may possibly be explained by a sort of coherer welding action at the contact, under the stimulus of the impressed voltage. The phenomenon appears to repeat itself more or less definitely in new samples of carbon under the same conditions. There is, however, a critical value of the impressed emf in each case, beyond which the reverse action occurs. That is, above the critical impressed emf the apparent resistance of the carbon-carbon light contact tends to rise for a little while with time of application. This effect may also be explained, perhaps, by an oxidation or squeezing out of occluded gas into the contact, as soon as the current density over the contact surface is able to liberate a certain amount of heat. At all events, the effect is opposite to the supposed coherer action at low voltages.

The reversal of the direction effect in contact resistance indicates the complexity of the actions which are liable to occur in a carbon contact when analyzed with care. We have to recognize a microphonic variation with pressure, a variation with time in one direction or the other, changes of contact resistance with temperature, and finally variation with current strength. Probably these different actions interfere or are seldom able to introduce themselves singly. A change in one particular is apt to induce a change in another. And this state of affairs, of course, does not smooth the path of the investigator who is trying to determine the behavior of the carbon-microphone transmitter in a telephone circuit under the action of sound waves.

Isolated Plant Economy

A somewhat typical plant for a large and important office building is described at some length in this issue. The design of equipment is in large measure a matter of rather intricate details of distribution service, but the key to the situation as regards economy must be looked for in the generating plant itself as influenced by the condition of its use. The economy of such an isolated plant, considering the conditions of its use in comparison with central-station service, has always been a moot point among engineers. A good deal of discussion has been spent on the matter in years past without reaching any very definite conclusion, and it seems to us that, considering the radical changes that have been made in central-station service in recent years, the problem should be again discussed from the standpoint of the present. We know of no thoroughly up-to-date examination of the load curves of office buildings or of the actual conditions of economy found in the plants. Such data are perhaps at hand, but have not been brought out into the light as they should be. There are available to those interested in the subject merely *ex parte* discussions by central-station men and occasional figures of a somewhat vague character from those who are operating isolated plants. It is difficult to determine offhand where the costs of energy from a plant operated by a single non-condensing engine without a battery to help over the peak meet those of central-station supply from a modern turbo-generator plant.

We seek for light on the above subject, and when it appears there will be a still further question of fact to settle. What would be the result of substituting for the equipment now common in this country in an isolated plant one of the "locomobile" units, with high pressure and high superheat, such as are being widely used in Germany for similar purposes? These units are very consistently reported as consuming less than 10 lb. of steam per brake-hp-hour, which means that in fuel consumption they can equal the record of even rather large turbo-generators. What would happen if such units were introduced generally into isolated plant practice in this country? For some reason or other the "locomobile" type of generating unit, extremely well known on the Continent and in use even in South America, has not yet penetrated American practice. When it does so valuable new data will soon become available for isolated plants.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

San Francisco Conventions in 1915

Arrangements are now being made for holding the annual conventions of various engineering societies in San Francisco during the exposition period in 1915. Included among these are the conventions of the International Electrotechnical Commission, during the week of Sept. 6; International Electrical Congress, week of Sept. 13; General Engineering Congress, week of Sept. 20, and International Gas Congress, week of Sept. 27. It is probable that the American Electric Railway Association will hold its convention during the week of Oct. 4.

It has been found undesirable, if not practically impossible, to hold the convention of the National Electric Light Association later than June, on account of certain constitutional provisions. It has been decided, therefore, to hold the 1915 N. E. L. A. convention during the week of June 14 at San Francisco.

Conference of Public Policy Committees

Upon the initiative of the public policy committee of the National Electric Light Association and the invitation of its chairman, Mr. Arthur Williams, the members of the public policy committee of the American Electric Railway Association met the other committee at dinner at the Union League Club on the evening of Feb. 18. The event must be recorded as historical in many ways and cannot but bear useful fruit in shaping the future of the two great industries for which these national bodies speak authoritatively.

The dinner was attended by President George H. Harries of the American Electric Railway Association and President F. M. Tait of the National Electric Light Association. The two committees were very fully represented by their members as follows: N. E. L. A.—Arthur Williams, chairman; E. W. Burdett, H. L. Doherty, C. L. Edgar, W. W. Freeman, T. E. Murray, S. Scovil and C. A. Stone. A. E. R. A.—T. N. McCarter, chairman; Patrick Calhoun, O. T. Crosby, James H. McGraw and W. H. Heulings. In addition to these there were present as representing great public utility systems or groups Messrs. Frank Hedley, J. H. Pardee, H. G. Bradlee, E. A. Maher, C. C. Peirce, John W. Lieb, Jr., and C. Loomis Allen. Judge E. P. Matthews was also present. The societies were also represented by their respective secretaries, T. C. Martin and H. C. Donecker, while the dinner and other arrangements of the conference were in the hands of Mr. Walter Neumuller.

While for several years with increasing intimacy and relationship the two national bodies have been working together on matters of common technical interest, this was the first attempt to bring under joint consideration what may be termed the larger questions which affect the service of the public, the condition of employees and the attitude toward the new regulating element which has come into such active play in recent years in the shape of public service commissions. From time to time during the past six or seven years there have been tentative efforts toward co-operative consideration of these highly important matters, but this dinner is the first occasion upon which anything really definite has been accomplished, and before its close it was unanimously voted to form a joint committee of five, each association to select two from the sister body and these four members to elect the fifth. It was felt in this way that a harmonious, cohesive and useful joint committee could act and speak for both bodies whenever necessary, with unquestioned influence and at short notice.

The meeting was addressed during the evening by Presidents Harries and Tait and by Messrs. McCarter, Williams, Edgar, Doherty, Hedley, Scovil, Maher and Burdett with an evident realization of the significance of the occasion. The speakers all manifested a high sense of personal and corporate responsibility in regard to the three relationships which have been mentioned above, and from time to time there were bursts of eloquence that made a strong appeal and deep impression.

Toward the close of the evening attention concentrated upon the proposed public utility bill which is being framed by the National Civic Federation embodying a model form of public service commission and regulation bill to be commended to states which have not yet placed their utilities under such a governing body, and the feeling was generally voiced and unanimously approved that, while such efforts should necessarily have the cordial support of the two great associations, it was the duty of their public policy committees, and indeed of every member, to assist in the shaping of such measures that the greatest good should be secured alike for the public, the employee and the investor.

The dinner, which began at 8 o'clock, lasted until 1:30 a. m., and even then the interest in the general subjects of discussion was so great that it was with reluctance the party broke up. It is understood that the joint committee will take form immediately and will at once assume the vital duties intrusted to it.

A. I. E. E. Affairs

The next annual convention of the American Institute of Electrical Engineers will be held in Cooperstown, N. Y., during the week beginning Monday, June 23, 1913. A unanimous decision on this point was reached by the board of directors of the Institute at a meeting in New York on Feb. 14. The board authorized a two-day Institute meeting in Pittsburgh, Pa., during the latter part of April, under the auspices of the committee on the use of electricity in mines, in co-operation with the Pittsburgh Section, A. I. E. E. The exact date of the meeting, which was left to the discretion of the meetings and papers committee, will be announced later.

In view of the unusual activity incidental to the holding of the midwinter convention in New York, Feb. 26, 27 and 28, 1913, and the lectures on radio-activity to be given under the auspices of the Institute's electrophysics committee, it was decided to omit the New York meeting, scheduled for Friday, April 11. The lectures on radio-activity had previously been announced for Tuesday evenings during the latter part of March and April, but upon recommendation of the meetings and papers and electrophysics committees the dates were changed to Wednesday evenings, March 19, 26, and April 2 and 9.

Upon the recommendation of the sections committee, the organization of a section was authorized at Spokane, Wash., in response to a petition signed by twenty-five members and associates residing in that territory.

Letters were read from the Verband Deutscher Elektrotechniker of Germany and the Koninklijk Instituut van Ingenieurs of Holland concurring in the plan proposed by the Institute last year for the exchange of visiting member privileges.

Convention of Engineering Societies in Spokane, Wash.

During the present week there is being held at Spokane, Wash., a convention of members of engineering and scientific societies of Spokane and vicinity. This meeting, while held under the auspices of local sections of certain societies and by members and associates of others, must not necessarily be understood as having official recognition of the societies whose members are participating. The object of the convention is to promote action, co-operation, better practice and a higher code of ethics, and to encourage the individual to become identified with that organization which will be most helpful to him. The officers of the committee in charge are Messrs. J. C. Ralston, chairman; C. S. MacCalla, vice-chairman, and L. K. Armstrong, secretary. Feb. 20 was electrical day, and the meeting was held under the auspices of local members and associates of the A. I. E. E., assisted by members of other societies. The chairman of the session was Mr. J. B. Fisken. The subjects of papers read on electrical day and on electrical subjects on other days were: "Long Lake Power Development," by Mr. C. S. MacCalla, general manager of the Washington Water Power Company, Spokane; "Electricity in Mining," by Mr. J. B. Fisken, superintendent of the Washington Water Power Company; "Illumination and Wiring of Large Buildings," by Messrs. W. K. Stacey and H. P. Peirce, Spokane; "Theory of Electric Transmission," by Prof. H. V. Carpenter, Washington State College, Pullman, Wash.; "Notes on System of Western Canada Power Company," by Mr. F. D. Nimms, electrical engineer, Vancouver, B. C.; "Conservation of Fruit and Other Food Products of the Northwest by Cold Storage and Mechanical Refrigeration," by Mr. H. G. Miller, mechanical engineer, Spokane. Among other papers the paper on "The Engineer and Engineering Education as Relating to Civic Responsibility," by Mr. J. C. Ralston, consulting engineer, Spokane, was of great general interest. On Thursday evening an informal reception was given and on Friday evening a banquet.

San Francisco Exposition Building

Brilliant lighting effects are promised as a feature of the Panama-Pacific International Exposition at San Francisco in 1915. There will be three main groups of buildings on a site covering 625 acres and running for about a mile west from Fort Mason along the water front of San Francisco Bay. Machinery Hall will be the largest single structure at the exposition, having a length of 967 ft. and a width of 367 ft. This building will have more than 1½ miles of ornamental cornices. The dominating architectural feature of the exposition will be the imposing tower of the Administration Building at the south end of the Court of Sun and Stars. This tower will be about 400 ft. high. It is said that on June 25, 1914, every building will be finished and that the exposition will cost $50,000,000. A number of foreign nations and thirty-four states of the Union have already decided to participate. White will form no part of the color scheme. Everywhere will be tints melting into others and forming beautiful effects in connection with the architectural design. The projectors style the exposition the "Dream City of 1915." On the large Ferry Building at the foot of Market Street in San Francisco there is now a large electric sign with the words "California Invites the World—1915—Panama-Pacific Exposition."

International Electrotechnical Commission

The special committees of the International Electrotechnical Commission met in Zurich, Switzerland, on Jan. 13 and continued their deliberations until Jan. 19. The meetings were held in the town hall and were presided over by Prof. Dr. W. Wyssling (symbols), Mr. M. Huber-Stockar (rating) and Dr. H. Zoelly (prime movers). The special committees were as follows:

Country	Symbols	Rating	Prime Movers
Austria	.....	Prof. Pichelmayer	Dr. K. Kobes
Belgium	Prof. E. Gerard	Prof. E. Gerard	.....
France	Prof. Paul Janet	M. P. Boucherot	M. Ad. Bochet
Germany	Geh.Dr.K. Strecker	Herr Leo Schüler	Direktor H. Tonnemacher
Great Britain	Dr. R. T. Glazebrook	Dr. Gisbert Kapp	Mr. Gerald Stoney
Holland	Prof. Dr. de Haas M.G.J. Van de Well	.....	.....
Italy	Prof. M. Ascoli	Prof. E. Morelli Signor G. Semenza	Signor G. Semenza
Norway	.....	.....	Mr. W. Fougner
Spain	Sr. L. de la Peña	Sr. L. de la Peña	Sr. L. de la Peña
Sweden	.....	Mr. J. L. la Cour	.....
Switzerland	Prof. Dr. Wyssling	Herr Huber-Stockar	Dr. H. Zoelly
United States	Mr. C. O. Mailloux	Mr. C. O. Mailloux	*Mr. Henry G.Stott

*Mr. C. O. Mailloux represented Mr. Stott.

Of the six publications issued by the commission during 1912 the most important related to standard symbols and the rating of electrical machinery. The discussion on symbols took two days, and there was considerable comment as to the relative importance of distinguishing between vector and scalar quantities as against electric and magnetic, some delegates regretting that for the sake of a comparatively small number of magnetic quantities the entire alphabet of script characters was unavailable for vector quantities, which, in their opinion, would to an increasing extent be bound to be employed by electricians in the practical solution of their many problems.

In German practice it is important to distinguish between vector and scalar quantities, and the special committee made certain modifications in its list of symbols so that should the German view find favor ultimately and script letters not be recommended for magnetic quantities, no confusion would occur by two identical letters being proposed for the same quantity whether magnetic or electric.

Three days were taken up in the discussion of rating of electrical machinery, most of the time of the delegates being naturally occupied in dealing with the numerous amendments to Report No. 17 of the International Electrotechnical Commission, issued in June, 1912, as the result of the work accomplished at Paris in May last, when after much preliminary discussion certain definite proposals were put forward. In view of expanding foreign trade the subject of international rating is undoubtedly of prime importance to the electrical industry of all countries. The British views were ably set forth by Drs. Gisbert Kapp and R. T. Glazebrook, the latter interesting himself particularly in the copper question and in the method of employing temperature correction, which until recently has not received adequate consideration. Dr. Kapp was assisted by the official representative of the British Electrical and Allied Manufacturers' Association. Modifications and new proposals had been received from many national committees and their consideration rendered the present proposals more complete and far more likely of acceptance by the industry than were the Paris proposals. The proposed international standard for copper was only briefly discussed, as Dr. Glazebrook and Prof. Paul Janet kindly consented to consult with the other national laboratories on the subject and transmit their final decision to the central office for submission to the Berlin meeting of the International Electrotechnical Commission.

The special committee on prime movers has after detailed discussion and modification adopted the report prepared by the Italian committee as the result of two years' work on

hydroelectric installations. The question of steam engines in connection with electrical plants will next engage the attention of the committee. An important proposal was unanimously adopted, "that the industrial unit of mechanical power be the kilowatt."

Detailed reports of the work of the special committees will be issued by the central office of the International Electrotechnical Commission without delay, and it should be noted that the proposals of these committees are to be submitted for the consideration of the various national committees with a view to their ratification at the next plenary meeting of the commission, which will be held in Berlin Sept. 2 to 6, 1913. The Italian Society of Electricians has decided to adopt the recommendations of the International Electrotechnical Commission as and when promulgated and to recommend their employment in all international specifications for electrical machinery. The Italian society has also decided to suggest that when the necessity arises in international contracts for an arbitrator he shall be chosen by the president of the international commission.

It is stated that the wisdom of the Turin meeting in appointing small international committees to discuss actual details and to formulate definite proposals has amply justified itself. The work of the Zurich meetings will undoubtedly be of real practical value to the industry, for when finally adopted at Berlin the Zurich proposals will be the foundation of international specifications for use by the electrical industry of all nations. Mr. C. Le Maistre, 28 Victoria Street, Westminster, London, S. W., is the general secretary of the International Electrotechnical Commission.

Electrical Development Conference

The list of the acceptances received thus far by Mr. James M. Wakeman, general manager of the Society for Electrical Development, Inc., in response to the invitation which the society has extended to many well-known men to address those present at the conference which it is to hold at the Engineering Societies Building, New York, on March 4 and 5, promises that many valuable suggestions for increasing the use of electrical energy and apparatus will be presented upon the occasion.

As has been stated previously in these columns, all persons interested in any way in the manufacture, sale or utilization of electrical energy or equipment will be welcomed by the society at the conference, the purpose of which is to get the ideas of the entire electrical industry upon concrete methods for effecting the purposes for which the society has been formed.

The preliminary program is as follows: "Opening Address," by Mr. Henry L. Doherty, president the Society for Electrical Development, Inc.; "Aims of the Society," by Mr. J. M. Wakeman, general manager the Society for Electrical Development, Inc.; "Where the National Electric Light Association Comes In," by Mr. Thomas Commerford Martin, executive secretary National Electric Light Association; "The News Value of Electricity," by Mr. Frank G. Gale, advertising manager General Electric Company; "Electricity and the Architect," by Mr. Frank E. Wallis, of Wallis & Goodwillie; "The Dissemination of News," by Dr. Talcott Williams, director of the School of Journalism, Columbia University; "Co-operation in the Electrical Industry," by Mr. J. Robert Crouse, National Quality Lamp Division; "An Electrical Advertising Campaign," by Mr. William D. McJunkin; "Selling a Commodity," by Mr. E. St. Elmo Lewis; "Merchandising Co-operation," by Mr. W. E. Robertson, vice-president Robertson-Cataract Company; "Efficiency in Local Advertising," by Mr. J. C. McQuiston, Westinghouse Electric & Manufacturing Company; "Electrical Development and the Electrical Contractors," by Mr. Ernest Freeman, president the National Electrical Contractors' Association.

Papers are also being prepared by other prominent men. A number of ideas and suggestions are being received, and a digest which Mr. T. C. Martin is making of these will be read and discussed. A banquet will be held at Delmonico's on the evening of March 5.

A. I. E. E. Lectures on Radioactivity

As noted elsewhere in this issue, it has been found necessary to change the dates for the series of lectures on "Radioactivity" to be given by Prof. Edwin P. Adams, of the Palmer Laboratory of Princeton University, under the auspices of the electrophysics committee of the American Institute of Electrical Engineers. The lectures will be given at 8:15 p. m. on Wednesday evenings, March 19 and 26 and April 2 and 9, in the auditorium of the Engineering Societies Building, 33 West Thirty-ninth Street, New York.

Lecture I, to be given on March 19, will cover the discovery of the property of radioactivity; radium and its preparation; ionization of gases; nature of the radiations from radioactive substances—alpha, beta and gamma rays.

Lecture II, to be given on March 26, will deal with the disintegration theory of radioactivity; the distribution of radioactive substance; radium and the age of the earth.

Lecture III, on April 2, will cover dependence of the mass of an electron on its velocity; the electron theory of matter; electrons in optical theory; Zeeman effect; emission and absorption of light.

Lecture IV, on April 9, will cover metallic conduction; indication afforded by the study of radioactivity regarding the structure of the atom; optical phenomena in moving bodies; the principle of relativity.

The lectures will be open to the membership of the Institute. The members of the American Society of Mechanical Engineers, the American Society of Civil Engineers, the Electrochemical Society and the Illuminating Engineering Society have also been invited.

Revision of National Electrical Code

The electrical committee of the National Fire Protection Association has just issued its bulletin of committee reports and suggested changes in the National Electric Code to be acted on at the biennial meeting of the committee on March 26 and 27. The sessions, which are open to all interested, will be held in the rooms of the New York Board of Fire Underwriters, 123 William Street, New York. As is now very generally known, the policy of the electrical committee of the National Fire Protection Association is to recommend only such changes as are made necessary by progress in the art or such as have been found by field experience to be necessary to safeguard against hazards. Not less than seventeen committee and sub-committee reports will be presented, and the suggested changes submitted for consideration by others than the committees cover over six closely printed pages. The reports deal with the New York code, Rule 1-d, Rule 2-b, block distribution, Rule 15, Rule 23-d, theater and moving-picture-establishment wiring, sign and outlet wiring, rubber-covered wires and cables, outlet boxes, switches and cut-outs, cabinets, sockets, fixtures, auto-starters and rheostats, and transformers, in addition to the usual reports from the laboratories. The report of the committee on Rule 15 makes the grounding of transformer secondary circuits obligatory. If the report of the committee on block systems is adopted, isolated plants will be unable hereafter to supply more than one building except by permission of the department having jurisdiction. Fuses will no longer be accepted as suitable protection from excessive currents for three-wire compound or shunt-wound direct-current generators. Double-pole, double-coil or four-pole circuit-breakers will be required hereafter.

The Electric Vehicle at Boston

At a meeting of the Electric Motor Car Club of Boston, Mass., at the Hotel Plaza, Boston, on Feb. 18, steps were taken to inaugurate a new advertising campaign in the Boston press, and Mr. O. G. Draper, formerly of the Boston *Herald* staff, was elected permanent secretary of the organization. Mr. Draper will give his entire time to the development of the electric vehicle, and is located at 39 Boylston Street, Boston. Closer co-operation of the club with the New England Section of the Electric Vehicle Association of America will probably follow.

New York Electrical Society

At a meeting of the New York Electrical Society, held on Feb. 17 at the Engineering Societies Building, New York, Mr. William J. Hammer gave a short address on the history of the incandescent lamp, referring particularly to the "William J. Hammer historical collection of incandescent electric lamps," recently presented by the General Electric Company to the Association of Edison Electric Illuminating Companies, which is now in the rooms of the American Institute of Electrical Engineers. The speaker, who was associated with Mr. Thomas A. Edison in the earliest days of the incandescent lamp, traced the developments of the various kinds of incandescent lamps from the very first attempts to the present time. He referred to the efficiency of the various kinds of material used for filaments, no incandescent lamp made to-day having an efficiency of more than 1 per cent. Considerably better results have been obtained experimentally with cold-light sources, which the speaker referred to as the light of the future

Following this address a demonstration and an informal talk were given on the Pollak-Virag telegraph system by Mr. V. C. Lovenc, an associate of Dr. Antoine Pollak, the inventor. Transmitting and receiving apparatus were shown in operation and sample messages were distributed among the audience.

The first operation in transmitting a message is performed by means of an apparatus resembling a typewriter. Instead of printing the message in ordinary type, the keys punch holes in a tape passing through the machine as needed. For each letter there is a characteristic arrangement of holes. This tape is placed on a transmitter and the message is delivered to the receiving station automatically and printed in ordinary script, as shown in Fig. 2.

The transmitter consists of a motor-driven drum *R* (Fig. 1), on which is unrolled the tape containing the message. The drum is made of six disks, *a, b, c, d, e, f*, insulated from each other. The disks are connected to a storage battery in such a manner as to give each one a different voltage.

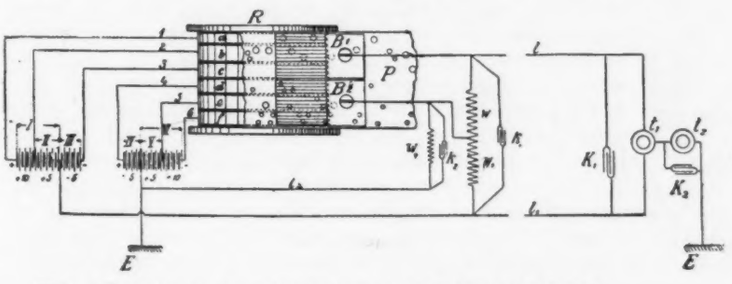


FIG. 1—DIAGRAM OF POLLAK-VIRAG TELEGRAPH SYSTEM

For each disk there is a contact brush, the brushes for disks *a, b, c* being connected at B_1 and those of *d, e, f* at B_2. As the tape passes between the drum and the brushes contacts are made through the holes. the impulses being transmitted through the apparatus to the receiving station. In running the tape at full speed 400 contacts can be made per second.

In reaching the receiving apparatus the electrical impulses act through magnetism upon the diaphragms of two telephone receivers, t_1 and t_2 (Fig. 3), which in turn act on a mirror, the latter reflecting the light from an electric lamp onto a strip of sensitized paper. The mirror is supported at a point *u*, the membrane *S* giving it a vertical motion and the membrane *W* a horizontal motion. The combination of the two motions, controlled by the punchings in the tape,

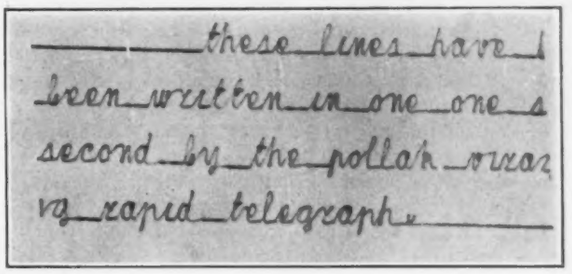


FIG. 2—MESSAGE RECEIVED DIRECTLY FROM APPARATUS

reflects the light in such a manner as to produce characters of the ordinary script type. The sensitized paper is automatically "developed and fixed" within the receiving apparatus and ready to be delivered. The light source referred to is an incandescent lamp *l* (Fig. 3) inclosed in a rotating cylinder *k*. In this cylinder there is a screw-shaped slot which, while rotating, moves the light across the sensitized paper strip, one line being written for each revolution of the cylinder.

As the horizontal and vertical components of the letters are of various lengths, the three disks, *d, e, f*, of the transmitter, acting on the horizontal membrane, and the disks *a, b, c*, acting on the vertical membrane, have different voltages. The disk *f* is connected to the battery so as to have a potential of + 10 volts and gives long horizontal lines, disk *e* corresponds to + 5 volts and gives short horizontal lines, and disk *d* corresponds to — 5 volts and gives lines in a reversed direction. In the same manner *a* has a potential of + 10 volts and produces a greater pressure on the membrane t_2, *b* with + 5 volts produces a shorter line, and *c* a line in reversed directions.

Difficulties such as deformation of the writing due to vibrations of the membranes on account of heavy external disturbances have been overcome by an arrangement which automatically discontinues the operation until such vibrations are properly damped.

Other disturbances, such as induction from adjacent wires or earth currents, are avoided by arranging the diaphragms so as not to be sensitive.

It is claimed that the transmitting and receiving apparatus can operate at a speed of 40,000 words per hour. This statement is indorsed by the Hungarian and French governments, which have submitted the system to tests on lines varying in length from 300 miles to about 700 miles.

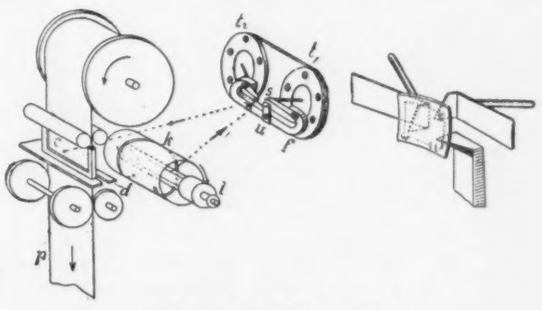


FIG. 3—RECEIVING APPARATUS

After the technical part of the program a reception for President Henry L. Doherty was held in the rooms of the American Institute of Electrical Engineers.

N. E. L. A. Booklet for Prospective Residence Customers

The publication committee of the Commercial Section of the National Electric Light Association, of which Mr. Douglass Burnett, of Baltimore, is chairman, met in New York on Feb. 15 to give attention to the final proofs of the new booklet to be issued on the subject of "Home Thoughts Electric" about March 1. The committee also considered the draft submitted for the booklet on "Store Service." These are two of a series of booklets prepared with the object of interesting prospective customers in electric service for residences. They are to be distributed by central-station companies and by electrical contractors in the course of "follow-up-by-mail" campaigns and at counters of salesrooms and by salesmen. Publications of this kind are also distributed by some companies with packages of lamps and appliances which are sent to customers. Evidently, central-station companies find such publications of great use, because 175,000 of the booklets of the Commercial Section have been distributed within the past few months. The new booklet, "Home Thoughts Electric," is personally indorsed as to its purpose by Mr. Edison, and it is confidently predicted that owing to its attractive method of presenting the reasons for the use of central-station service in residences there will be a very large demand for the publication. The committee contemplates issuing 150,000 copies of the booklet at once.

Dinner to Brooklyn Electrical Contractors

The annual dinner given by the Edison Electric Illuminating Company of Brooklyn to the electrical contractors of that borough was held at the Union League Club on Feb. 15. Some 250 contractors partook of the hospitality of the Edison company, which for some years has worked with the electrical contractors of the borough in a most loyal spirit of co-operation. Mr. T. I. Jones, general sales agent of the company, acted as toastmaster and addresses were made as follows: Mr. John P. Bonney, president of the Kilowatt Club, on "The Brooklyn Contractor"; Mr. Lewis H. Pounds, Commissioner of Public Works Borough of Brooklyn, on "The Borough of Brooklyn"; Mr. Charles L. Eidlitz, past-president National Electrical Contractors' Association, on "The Co-operative Movement"; Mr. Milo R. Maltbie, Public Service Commissioner of the First District, New York, on "The Public Service Commission"; Mr. Joseph C. Forsythe, chief inspector New York Board of Fire Underwriters, on "The Underwriters' Work"; Mr. Douglass Burnett, manager of the electric commercial department of the Consolidated Gas, Electric Light & Power Company, Baltimore, Md., on "The Central Station and the Contractor."

Mr. Bonney in his speech intimated that legislation will shortly be enacted calling for the licensing of electrical contractors in New York State. In describing the work of the Public Service Commission, Mr. Maltbie reiterated the policy of the State in making central-station service monopolistic where such service is adequate and reasonable and where the company meets the requirements of the Public Service Commission. According to Mr. Forsythe, there were 68,000 applications for inspection filed with the New York Board of Fire Underwriters last year, which resulted in the issuance of 55,000 permits and necessitated 161,000 inspections. These data were given in order that those present might have some comprehension of the work of the New York Board of Fire Underwriters. Of the 5000 or more fires attributed to defective electric wires, inspection revealed only forty-two due to that cause, and the total loss approximated $40,000. Half of the forty-two fires caused by electricity were due to poor workmanship and one-quarter to defective material. Mr. Burnett wove his speech around the "slogan" "Service first," and showed its application to the central station and the contractor. The only tinge of regret in the very happy speech of Mr. Eidlitz was that the electrical contractors of the city are not regulated by the Public Service Commission. Mr. Jones in the opening speech dwelt on the bonds of co-operative fellowship existing between the Brooklyn electrical contractors and the Edison company.

High-Powered-Lamp Discussion at Boston

A symposium on high-powered lighting was held at Boston on Feb. 17 at a joint meeting of the New England Section of the Illuminating Engineering Society and the Boston branch of the American Institute of Electrical Engineers. The speakers were Mr. Percy H. Thomas, New York, on "Mercury-Vapor Lamps of the Quartz Type"; Mr. C. A. B. Halvorson, Jr., Lynn, Mass., on "Ornamental Magnetite Lamps," and Mr. W. H. Darrah, East Pittsburgh, Pa., on "Inclosed-Flame Lamps." In discussing the quartz type of mercury arc lamp Mr. Thomas pointed out that its efficiency is about twice that of an ordinary mercury-vapor lamp, but a disadvantage is its brilliancy as affecting the eye. It also casts shadows sharper than those cast by the mercury-vapor lamp with its longer tube. It is substantially a constant-current device and can best be adjusted by securing the proper voltage drop across its terminals as measured by a voltmeter. Current changes are effected by changing the natural cooling of the device. Quartz-tube mercury-vapor lamps designed for constant potential operation do not work well in series, as no opportunity exists for adjustment. At the next meeting Mr. Preston S. Millar, New York, will speak on "Various Types of Lighting."

The Making of Investments

Mr. Charles G. Dawes, president of the Central Trust Company of Illinois and former Comptroller of the Currency, addressed the Electric Club of Chicago on Feb. 13 on "The Philosophy of Investment." The speaker discussed various forms of investments. He pointed out that investments in real estate may be regarded as made in a business which is competitive, except as to the monopoly of the ground used. A large office building, as a whole, is not to be regarded as a particularly profitable investment. The speaker warned against schemes where extraordinary profits were predicted and described operations on the Stock Exchange and the Board of Trade, telling about the formation of pools, the making of "wash" sales and the manipulation of prices. For the small investor seeking a better investment of his money than can be obtained in savings banks or high-class bonds, he suggested that he invest money with the man who has been successful and invest it in the business in which he has been successful. Electric-service and gas properties, properly operated, cannot lose money, said Mr. Dawes. These utilities take a little profit from a great many people; as the town grows their business grows, and they share what some people might call "unearned increment" in this way. They are, by nature, monopolies. Mr. Dawes referred briefly to the bonds of irrigation projects and told why he did not have a very high opinion of them. He answered several questions and among other things said that he thought state public utility commissions were all right if administered for the real interest of the public and not for political effect. The so-called "watering" of stock, he said, is not so bad as often represented. In nine cases out of ten it represents no hardship or unfairness or dishonesty; it may enable the man without capital to reap some reward from his initiative. The speaker also briefly described the principles on which holding companies operate.

Accidents and Their Prevention

More than 750 employees of the Rochester (N. Y.) Railway & Light Company and invited guests attended the meeting of the company section of the N. E. L. A. in the banquet hall of the Powers Hotel on Feb. 11. The meeting was in charge of the general safety committee of the Rochester Railway & Light Company, and opened with an address on "Accidents and Their Prevention," by Mr. Victor T. Noonan. During the course of the evening motion pictures showing safety devices and guards on machines in operation at the Eastman Camera Works were shown, as well as lantern slides illustrating the work of the Rochester Railway & Light Company. The latter is said to be one of the first companies in the country to take up a systematic campaign against accidents, and it is understood that it is also the first electric light company to have pictures taken in its various plants and departments showing safe and unsafe ways of working. Lantern slides showed in addition careless habits, safety devices in the gas works and gas street department, and included almost everything from a lineman climbing a pole without his safety belt to a bookkeeper turning the ledger leaves the wrong way. Slides also were used to show safety devices of the New York Central Railroad, the National Association of Manufacturers and the United States Steel Corporation. Among the organizations represented at the meeting in addition to the Rochester Railway & Light Company were the Buffalo, Lockport & Rochester Railway, Buffalo; Rochester & Pittsburgh Railway, Rochester, Syracuse & Eastern Railway, New York State Railways, New York and Rochester telephone companies, Chamber of Commerce, Board of Education, police and fire departments and the Rochester Engineering Society.

New England Power Company Expanding

Rapid growth of business on the new system of hydroelectric transmission service recently inaugurated by the New England Power Company of Shelburne Falls, Mass., has necessitated pushing ahead with plans for the construction of the so-called Hoosac development, by which 12,000 kva in generating machinery will be added to the resources of the organization. Press notices state that the company has applied to the county commissioners for authority to build a dam on the Deerfield River about three-quarters of a mile south of Monroe Bridge, in the town of Monroe, and that the hydraulic work will be pushed forward as soon as the conditions permit. According to the general plans of the company, which were outlined in the *Electrical World* of Dec. 28, 1912, page 1365, a concrete dam 235 ft. long will divert water from the river into a conduit and canal about 2.5 miles in length, from which it will be delivered to the wheels in the power house at Hoosac at a net head of about 200 ft. The waterwheels are to be directly connected to three 4000-kva generating units, each consisting of a 60-cycle and a 25-cycle generator mounted on a common shaft. These machines act as frequency changers between the New England company's system and that of the Boston & Maine Railroad, whose electrified train service through the Hoosac Tunnel is operated by 25-cycle, single-phase locomotives.

In a recent interview President George S. Smith stated that about 100 miles of transmission line are being built by the New England Power Company and allied interests to distribute power generated by the Connecticut and Deerfield River plants, and that these will be in complete operation during the coming spring. Contracts already closed will aggregate between $400,000 and $500,000 annually. The completion of the Hoosac station, known as the company's No. 5 plant, will add roughly 80 per cent to the capacity of the system, and although it had not been intended to equip this plant until 1914, the expansion of the business necessitated immediate steps toward the work. Work on the large storage reservoir is progressing satisfactorily at Somerset, Vt., and of its total capacity of 2,700,000,000 cu. ft., there should be provided for the dry season of the coming summer about 700,000,000 cu. ft., the completion of the basin being expected in the fall of the present year. Rapid progress is being made on the tie transmission line which is being built between the Millbury plant of the Worcester Consolidated Street Railway and the Greendale lines of the Connecticut River Transmission Company, by which a complete loop is to be formed from the Deerfield River plants through the Worcester district and the Vernon plant of the Connecticut Company back to the Deerfield stations.

Electrical Developments Near Pittsburgh, Pa.

The Kuhn interests of Pittsburgh, Pa., which control the West Penn Electric Company, are preparing to put in three dams on the Cheat River, Va., each of which will produce 50,000 hp, and, provided the necessary permission shall be obtained, the first will be in operation about Jan. 1, 1914. Certain dams will also be established on Sandy Creek, in West Virginia, which will provide additional power. The same interests also control the fall at Ohiopyle, Pa., where there is a drop of 110 ft., together with reservoir rights on the Youghiogheny River, so that ultimately about 250,000 hp will be available for commercial purposes around Pittsburgh. The West Penn Electric Company has at the present time a steam station at Connellsville, rated at 52,000 hp and operating with coal costing about $1 a ton. The energy is transmitted as far as Butler, Pa., 120 miles away, and at the present time there are some 110 coal mines with connected loads ranging from 200 hp to 5000 hp being supplied from the company's system, not to mention the numerous municipalities centering around Connellsville. With the establishment of the hydroelectric plants referred to a tension of 110,000 volts will be adopted for transmitting the electricity.

Report of Commonwealth Edison Company

Some interesting statistics are given in the annual report of the Commonwealth Edison Company of Chicago, just issued. The company's connected business (exclusive of electrical energy supplied to other public-service corporations) amounted to the equivalent of 8,293,523 standard 16-cp lamps on Dec. 31, 1912. The company has five generating stations and forty-one substations. The total number of customers is about 182,000, the average retail lighting rate is a little over 7 cents and the average number of lamps connected per customer is about twenty-eight. An analysis of the total operating revenue for 1912 of $15,362,000 shows that the largest portion, $7,261,000, or 47 per cent, came from the sales of electricity for lighting at retail; $3,704,000, or 24 per cent, was for electricity supplied to railway companies; $2,602,000, or 17 per cent, was for energy supplied for industrial purposes at retail, and $1,788,000, or 12 per cent, was for wholesale energy for lamps and motors. The total earnings have doubled about every four and a half years. Of the $1,144,000 paid in taxes and municipal compensation in 1911, a little less than $700,000 was for personal and real-estate taxes, and nearly $400,000 was for municipal compensation, the remainder being the federal corporation tax. For every dollar of earnings in 1911 over 8 cents was required for taxes. The constantly increasing demand for electric service has necessitated a large addition to the Fisk Street station, which eventually will be doubled in output. A 35,000-hp Parsons turbine and generator unit is being installed and in addition the company has ordered from the General Electric Company a 27,000-hp Curtis turbine and generator. The annual meeting of the stockholders will be held on Feb. 24.

Verdict of Criminal Conspiracy Returned Against Trust

The recent decision by the Supreme Court in the so-called bathtub case is still fresh in the minds of many who have followed the patent situation. In that decision it was held that the license agreements transcended what was necessary to protect the patented dredger for making enamel-ware and passed to the purpose and achieved the results of a monopoly. The case was then remanded to the lower court for the trial of the pending indictments under the criminal clauses of the Sherman act. Two indictments had been returned by the federal grand jury charging that by criminal conspiracy the defendants controlled 83 per cent of the output of enameled-ware and by means of patent license agreements restrained trade and dictated prices to the jobbers and retailers.

On Feb. 14 a jury sitting in the federal District Court at Detroit, Mich., returned a verdict of guilty on the conspiracy charge. The act is a misdemeanor, punishable by not more than one year's imprisonment or a fine not exceeding $5,000, or both. Judge Sessions on Feb. 15 imposed fines on the fourteen individual and thirteen corporate defendants ranging from $1 to $10,000. The fines totaled $51,007. The judge explained the differences in the fines on the ground of the financial circumstances of each defendant and the parts the various defendants played in the conspiracy. He furthermore overruled the Attorney-General's request that three of the individual defendants be imprisoned, on the ground that in the former trial they were dismissed, thus raising some doubt as to the propriety of an extreme punishment. The defense has made no statement as yet in reference to an appeal from the verdict.

Good Will in Public Utilities

In an address before the New York Edison Commercial School on Feb. 13 Mr. T. C. Martin, secretary of the National Electric Light Association, speaking to the topic "Good Will in Public Utilities," intimated that the public service commissions have not yet discovered that with between thirty and forty in full operation they are rapidly drifting into chaos, confusion and contradiction, and that one thing above all others needed now is uniformity and standardization of verdict, ruling, regulation, requirement, phraseology and definition. The art being one, Mr. Martin maintained that its governing conditions must harmonize. The speaker pointed out that good will in utilities under the new conditions is taking on a novel aspect and suggested that one conception of good will may be said to be human effort imposed upon raw material. Expanding on this theme, Mr. Martin said there is not a public-utility system in this country that has not had built into it the labor, anxiety, energy, tears, self-sacrifice and lives of loyal and faithful workers, so that the physical-valuation idea by itself cannot hold. The intellectual value of a property was touched upon by the speaker, who maintained that in spite of all that has been said by the great authorities about the value of good will, the tendency has been to neglect entirely the intellectual value of a system or property, though without such value no property could be run.

In summing up his speech Mr. Martin formulated his ideas about good will in public utilities in the following series of propositions: (1) Good will is the intellectual value of a public utility as distinguished from and in addition to its physical value. (2) Intellectual value is cumulative, perpetual and eternal. Good will lives. The physical value is subject to constant depreciation, never renews itself, and ever demands new capital and new construction. (3) Intellectual value is based upon the human element and function. One man can renew a plant three, five or seven times in his career with growing knowledge, experience and judgment. The value that goes into the plant is "he," not "it." (4) The personal responsibility now looms up because there can be no intellectual value or moral value without a human personality behind it. That narrows it down to each one, to foster good will where inherited, to create it where non-existent. (5) The earning power of a property does not lie in its physical elements. It lies in effective administration, efficient management, loyal devotion of every officer and employee to the ideal of satisfactory public service. Good will is "we" to the extent of our ability to do and give good service. (6) Intellectual value of a property carries with it the implication of a recognized value of the individual who contributes to its creation and of a value that may continue long after he has ceased to throw a switch, figure a balance sheet, bring in a new customer or open up a new line of consumption.

Patent Office Employed to Harass Competitors

On Feb. 13 a jury verdict of guilty on three counts in the indictment charging conspiracy under the Sherman act was returned against President John H. Patterson and twenty-eight other officers of the National Cash Register Company at Cincinnati, Ohio. Besides charging that nearly all competitors had been driven out of business by illegal methods, and that a monopoly of the cash-register business had been created by these means, it was also charged that the company had applied for patents on the machines and improvements invented by competitors. The latter means was used to harass their business opponents, in addition to such tricks as selling bogus imitations of competitive machines, threatening lawsuits and organizing "fake" competitive companies.

The defendants were sentenced on Feb. 17 by Judge Hollister, who imposed both a fine and a jail sentence in each case except one, in which judgment was set aside. The fines were as high as $5,000 and the maximum sentence was one year. The company's commercial practices were denounced by the judge, who said in part: "I have never heard of a legitimate concern having a competition department whose sole duties were not to sell goods but to prevent the sale of goods by competitors." Notice of appeal was given by the attorneys for the defendants.

This is the second case in which jail sentences have been imposed under the Sherman law. The first instance was that of the "turpentine trust," when three men were sentenced to serve three months. Their case is now on appeal in the Supreme Court.

Senate Defeats Federal Tax on Water-Powers

The proposal of President Taft and Secretary of War Stimson that the federal government have control over water-power sites to the extent of imposing a "reasonable annual charge" was defeated in the Senate on Feb. 17. The issue was fought out on the Connecticut River dam bill, in which was included a provision for an annual federal tax. On the motion of Senator Bankhead, of Alabama, the provision was stricken from the bill. With that out the bill passed by a vote of seventy-four to twelve.

An amendment was made to the bill, at the suggestion of Senator Borah, making hydroelectric transmission companies having transmission lines passing from one state to another subject to the control of the Interstate Commerce Commission and to the interstate commerce laws. Another amendment, added, by Senator Jones, gives the Secretary of War the right to cancel the privileges on the Connecticut River granted by the measure to the Connecticut River Power Company if the company ever becomes part of an unlawful monopoly or corporation or ever enters into any contracts in restraint of trade.

Notwithstanding the passage of the bill by the Senate, the Secretary of War does not yield to the Senate in his belief in a federal tax on water-powers. He issued a statement, following the passage of the bill, voicing the opinion of the administration and the advocates of the tax, which is in part as follows: "A dam is to be built by the Connecticut River Company at the Enfield Rapids, on the Connecticut River. This dam will promote navigation and it will also create valuable water-power for that company. I insisted that the company, as one of the conditions under which it was to obtain the government's consent for the construction of the dam, should pay into the national treasury a share of its net profits above 8 per cent, this money to be applied by the government toward the improvement of the navigation of the Connecticut River. The company was quite ready to do this, and the arrangement was carefully drawn up and agreed upon. The majority of the United States Senate, comprising almost all of the Democratic members, are unwilling to permit this contribution to be made to the national treasury. They insist that this valuable privilege shall be granted to the Connecticut River Company without any such return, and they insist upon this in face of the fact that the company is ready to pay it. I do not believe that such a position is good law or good business or good politics, and I venture the prediction that in spite of this apparent rebuff the day when these valuable water-powers will be given away for nothing is over."

It is stated in Washington that the fight for the principle involved will be resumed at the extraordinary session of the Senate which was called by President Taft on Feb. 18 to convene on March 4. It is the intention of the advocates of a federal tax on water-power sites to renew the fight at every opportunity, and as bills granting the privilege of constructing dams are constantly being introduced in Congress, there will be no lack of opportunities for the advocates of the principle.

Chicopee (Mass.) Power Issue Settled

By a unanimous vote the Board of Aldermen of Chicopee, Mass., has granted over the veto of Mayor Rivers a franchise to the Amherst Power Company which authorizes the erection of 400 poles in the municipality and the consequent distribution of electrical energy from the hydro-electric and steam auxiliary stations of the company to power consumers in the community. Representatives of the company have announced their willingness to enter into reasonable business arrangements with the competing Warren Power Company for the joint use of poles. In the event of a disagreement the joint use of poles may be ordered by the State.

Patentee Held to Have No Right to Fix Resale Price

Those who have held that a patentee has the right to fix the resale price on his patented article or device, on the ground that the statute gives him the unlimited right to exclude all others from making or vending his device during the term of the patent grant, were undoubtedly dumfounded at the decision rendered this week by Judge Ray in the United States District Court at New York. The Waltham Watch Company, of Waltham, Mass., asked the court to enjoin Mr. Charles A. Keene, a New York jeweler, from selling at less than its fixed price one of the watch movements patented, manufactured and sold by it.

Mr. Keene contended that after purchasing the watches they became his exclusive property and that he could sell them for whatever he wished. He also alleged that the Waltham company, although it charged $28.50 for the movement in this country, sold it to exporters for $10. Every watch sold by the manufacturer, it is said, contained a notice that the jobber or retailer thereby bound himself to regard the price agreement.

Judge Ray, in sustaining Mr. Keene's contention and dismissing the application for injunction, held that it was contrary to public policy to permit a patentee to prescribe the terms of resale. The court said further that the case had no paralled in Henry versus Dick, where the restrictions related to the use of the patented machine rather than its sale. In the latter case the patentee, said the court, was to receive his reward in part from the use of the machine.

Burton Act to Be Extended

At a conference between Secretary of War Stimson and the House foreign affairs committee this week it was decided to postpone all legislation for the control of the power companies operating at Niagara Falls. The Cline bill, indorsed by the committee on foreign affairs, also received the indorsement of Secretary Stimson, but owing to the congested condition of business in the House the committee decided it would be unwise to press the bill at this session. Secretary Stimson advised that the Burton law, which will expire on March 4, be extended and this extension will probably be granted.

Jovians and Society for Electrical Development, Inc.

Mr. James M. Wakeman, general manager of the Society for Electrical Development, Inc., spoke on "The Latest Expression of Jovianism" at the semi-monthly luncheon of the New York Jovian luncheon club on Feb. 19. Mr. Wakeman, who was the Apollo of the fifth Jovian congress and was prominent in the early history of the order, recalled the days when the membership numbered only about 500 and also told of the work done by Mr. J. Robert Crouse in fostering a spirit of co-operation among electrical men.

He said that the purpose of the Society for Electrical Development, Inc., to increase public demand for electrical energy and appliances, is one of co-operation, and that, as the purpose of the Jovian Order, representative of fraternalism in the electrical industry, is also one of co-operation, these bodies have a common purpose and can accomplish much of mutual advantage by acting together. He extended to the entire order an invitation to attend the conference which the society is to hold in New York on March 4 and 5, as noted elsewhere in this issue, and to send suggestions of methods for carrying on the society's work to Mr. T. C. Martin, who is making a digest of the many ideas along this line that have already been forwarded. He also invited the order to take part in the discussion at the conference and to attend the banquet which the society is to hold at Delmonico's on the evening of March 5.

Mr. Wakeman instanced as an example of the things which Jovians could do along the lines of practical co-operation that a lamp salesman might complain of the absence of an electric fan in a barber shop on a hot day, thus helping the fan salesman toward securing an order, or that a fan salesman might complain when he found inadequate lighting service in a hotel room and thus help to pave the way for the lamp salesman. Each by such methods will help to increase the use of electrical energy.

Mr. Charles L. Eidlitz, electrical engineer and contractor, of New York, of long connection with the Jovian Order, being called upon, said that too many Jovians are content merely to belong to the order, remain inactive and let someone else do the actual work. Mr. W. C. Andrews, of the membership committee, reported that he had received the names of 123 prospective members for the next rejuvenation, which is to take place in March, and that an excellent program had been arranged for the occasion.

New Public Utilities Board for Massachusetts Proposed

A bill is being drafted in the Legislature providing for a new public utilities board to be known as the transportation commission, with supervision of railroads, electric railways, steamships, express companies, telephone and telegraph service. The bill is a redraft of the Washburn bill to give more power to the Railroad Commission, and resembles the public utilities measures advocated by Governor Foss for the past three years. The proposed board would have five members, the chairman's salary being $10,500 and the other commissioners' $10,000 each. If the present bill is enacted the Gas and Electric Light Commission will be retained as at present, with regulatory powers over central stations, gas companies and municipal plants.

Public Service Commission News

Massachusetts Commission

The Gas and Electric Light Commission gave a hearing at Westfield upon the petition of the municipal light board for authority to reduce the price of gas from $1.10 to $1 per 1000 cu. ft. and of electricity for lighting purposes from 10 cents to 7 cents per kw-hr. The town also desires to lower the electric energy rates for motors, establishing a sliding scale of from 4 cents to 2 cents per kw-hr., depending upon the quantity used. Manager T. T. Logie of the lighting department testified that by establishing a lower energy rate for motors than already obtains larger consumers could be induced to sign contracts for service, and that the additional business would enable the plant to be more economically operated per unit of output. At present about 2800 hp is required to operate the factories in the town, which is the largest center of whip manufacturing in the world. The town electric plant furnishes about 500 hp in this service at present. Representatives of the Westfield Power Company, a concern supplying about seventeen tenants with a total of about 175 hp, objected to the reduction in energy rates for motors on the ground that the municipality had no right to offer service at prices below its actual cost of production. Chairman Barker called attention to the disadvantages of the law requiring depreciation to be figured at 5 per cent by municipal plants and said that a thorough investigation would have to be made before the board would decide the issue. Commissioner Schaff criticised the proposed sliding scale for motor service, suggesting that the municipal plant should offer both large and small manufacturers equally favorable rates. The proposed entry of the Amherst Power Company into the town was mentioned, and the commissioner voiced the opinion that a five-year contract between the company and the town should not be exceeded, in view of the possible future of water-power development in the Connecticut and Westfield Valleys. General Schaff also said that the municipal lighting department should be run at a profit and according to business principles generally. The case was taken under advisement.

Ohio Commission

The Public Service Commission has ordered the Cleveland, Painesville & Eastern Railroad to install side arms, supported by brackets, on its lines between Painesville and Willoughby Township, the side arms to be of sufficient length and so placed as to afford a clearance of not less than 6 ft. between any one and all of its high-tension lines and the nearest wire of the Western Union Telegraph Company. The company is also ordered to insert a suitable strain insulator in every case where a strain guy is used on the south side of any pole north of the lines of the Western Union Telegraph Company between the eastern limits of Painesville, Ohio, and the point of crossing at the east line of Willoughby Township, and to insert a similar insulator in the guy close to the point where said guy is attached to the anchor bolt. It is required in every case where a strain guy is installed on the south side of any pole to install a strain guy upon the north side of the pole, or, if the installation of a strain guy on the north side of the pole is found to be impracticable, then a push guy shall be installed on the south side of the pole in such manner as to prevent the pole leaning south under the combined influence of the strain guy and the prevailing north winds. It was further ordered that the company be required to maintain a clearance distance of not less than 6 ft. between any and all of its high-tension transmission lines or wires and any and all of the wires of the Western Union Telegraph Company. The changes and improvements are required to be fully completed on or before March 1, 1913, and the company must cause an inspection to be made, by competent linemen, at regular intervals of not to exceed ten days, of all and every part of its high-tension line between its generating station in Painesville, Ohio, and its substation in Willoughby, Ohio, and this inspection shall be made to include and cover insulators, tie wires, pins, cross wires, ground wires and their support and the wire connecting the ground wire with the earth. The company is required to keep on file, subject to inspection by the Public Service Commission of Ohio, all reports of inspections made hereunder and all reports of trouble on this line.

Current News and Notes

Rejuvenation of Minnesota Jovians.—A rejuvenation of the Sons of Jove is announced to take place in Duluth, Minn., Feb. 22. The affair falling on a holiday, prospects for a large attendance are promising. Many prominent men in civic and sectional circles have been invited to attend.

* * *

Hydroelectric Power for Nashville.—The long transmission line from the Ocoee River hydroelectric development of the Tennessee Power Company to Nashville, Tenn., will be completed early in May, it is expected. This transmission is operated at 66,000 volts, and the wires are carried on steel towers. The energy will be supplied to the Nashville Railway & Light Company for distribution.

* * *

Denver Telephone Company Outlawed.—At a special election held on Feb. 14 an ordinance initiated by petition was passed declaring the Mountain States Telephone & Telegraph Company an outlaw on Denver streets and alleys. Rates were established for unlimited, measured service and residence telephones, and the telephone company is required to apply within a limited time for a franchise.

* * *

Central Station Compelled to Use Ice for Making Steam.—With the Arkansas River frozen solid and the city water supply shut off, the municipal electric light plant at Tulsa, Okla., was compelled to melt more than 1000 cakes of artificial ice for water to keep its boilers running last month. When the ice supply was exhausted the plant was compelled to shut down, leaving the city in total darkness and the street cars tied up.

* * *

Municipal Plant Wants a 13.5-Cent Rate.—According to the St. Louis newspapers, the Board of Aldermen of Kirkwood, a suburb of that city, is considering the reported need for an increase in the municipal electric-service rates from 12.5 cents to 13.5 cents per kw-hr. This will put the price above that of the Suburban Electric Light & Power Company of St. Louis, which is delivering electrical energy there at a gross rate of 12.5 cents.

PROPOSED MUNICIPALIZATION OF ALL NEW PUBLIC UTILITIES IN INDIANA.—A bill has been introduced in the Indiana Legislature providing that no municipality shall grant a franchise to a gas, electric light or power company until the question of buying the public utility has been voted on by the people. The proposed bill will give a city authority to issue bonds for the purchase or lease of such a plant.

* * *

NOVEL USE FOR CLAY CONDUIT.—That more than one kind of "juice" may be run through a conduit is illustrated by the novel use which a wealthy wool merchant of Philadelphia is said recently to have made of some 600 12-in. lengths of vitrified-clay conduit. These tile ducts are being built into the wall of a wine cellar to serve as receptacles for wine bottles. Each piece of conduit being about 4 in. in diameter and a foot in length, is just the right size to hold a quart bottle comfortably.

* * *

SAFETY TRAINING IN PUBLIC SCHOOLS.—The committee on welfare and sanitation of the United States Steel Corporation has induced the Board of Education of Pittsburgh to place in the curriculum of all the minor schools a course of training for the purpose of enabling children of workmen to absorb, in the course of their regular classroom duties, principles of caution and self-protection. The committee also intimates that technical colleges will soon begin a course of systematic instruction of engineers in the matter of foresighted protection of the men to come under their direction.

* * *

BILL TO PROHIBIT EXPORTATION OF ENERGY FROM WASHINGTON.—The Senate and House irrigation and arid-land committees of Washington State have before them a bill which provides that waters or streams in the State necessary for irrigation cannot be used for the generation of electricity to be sold in other states. The primary object of the measure is said to be to prevent the Northwestern Electric Company from proceeding with its extensive operations on the Klickitat River. The company is damming the stream, erecting power houses and spending several millions of dollars on a hydroelectric system, the greater part of the energy from which is to be disposed of in Portland, Ore. The water is all that is available for the irrigation of some 500,000 acres of arid land in Klickitat, Yakima and Benton Counties.

* * *

CIVIL SERVICE EXAMINATIONS FOR FIRST AND SECOND CLASS STEAM ENGINEERS.—On March 5 the United States Civil Service Commission will hold an open competitive examination for first-class steam engineer. Practical knowledge of mechanical and electrical engineering and operation of heating and lighting plants and elevator machinery will be necessary. The salary is $1,200 a year. Form 1312, to be had from the United States Civil Service Commission, Washington, D. C., outlines the requirements for those who desire to take the examination. An examination for assistant steam engineer takes place on March 6. This is for the position of engineer in the Quartermaster Corps of the army at San Juan, Porto Rico, at $100 per month, the usual entrance salary being $1,000 per annum. The subjects will be the same as in the examination for first-class engineer. Form 1800 gives detailed information regarding this examination and the places where it is to be held.

* * *

ELECTRO-STIMULATION OF WINTER EGG OUTPUT.—Until recently Mr. Oscar L. Hallack, a poultry producer of Ossining, N. Y., viewed with alarm the decreasing egg output of his flock of hens as the hours of daylight shortened with the coming of winter. Learning, however, of the advantages of central-station service in other industries, Mr. Hallack conceived the idea of installing electric lamps in his chicken house, and these he now switches on each day at the early hour when he goes about his matutinal milking. With the advent of this false dawn the henhouse is immediately astir, the cocks begin to crow, and the hens promptly set about their day's work of scratching. By again turning on the illumination at the approach of dusk, the electrical hengineer is, in all, able to prolong barnyard activity and production to the span of a July day. Of course with the shortening winter days there comes a corresponding increase in the electric-light bills, but the increased industry and output of his feathered helpers leaves for the astute poulterer a handsome margin of profit.

* * *

EMPLOYMENT EXCHANGE FOR TECHNICAL MEN.—Mr. H. C. Spaulding, an 1887 graduate of the Massachusetts Institute of Technology, who has been connected with various electrical and mechanical organizations, including the Thomson-Houston Electric Company, the Siemens & Halske Electric Company, the Blake & Knowles Pump Company, the Yale & Towne Manufacturing Company, etc., has been placed in charge of the new technical employment department recently established by the National Employment Exchange. The exchange, whose offices are located at 30 Church Street, New York, has now completed its third year, having been founded by a group of well-known business men who realized the need for a reliable and substantial clearing house between employees and employers. Although not yet on a self-sustaining basis, the cost of operation has steadily decreased. The growing number of requests for and applications from men of technical training has demonstrated the advisability of establishing the present new technical department devoted solely to this class of employees, and the recognition already accorded it by engineering and business concerns seems to indicate the wisdom of the step.

* * *

THE COMPLETE ELECTRIC VEHICLE.—A Long Island woman recently addressed to the Electric Vehicle Association of America the following request for assistance in obtaining fulfilment of her ideals concerning electric-automobile construction: "Could you build an electric car, on the small van design, and equip same with living accommodations for three adults; have the electric motor power to be used on electric cooking appliances—say, for instance, making use of my own ideas, of papier-mâché washbasin and drain pipes, the same to be thrown away each day; collapsible rubber bathtub, fastened in a compartment under a trap door in floor of car; walls lined with quilted satin sectional flaps, hiding compartments and shelves for clothing; also cot beds to be folded back against the wall—same for tables and campstools; mirror panels, electric light and flat wicker hamper on roof of car—same surrounded with guard railings; extension porch folding under exit door; chauffeur's seat convertible into a cot on the Davenport bed plan? What would be total cost of such a car? Walls to be satin—floor stained cork mat—or inlaid rubber flooring like that used on the new ferry boats; long narrow windows swinging outward and shutter ventilators high above and in the roof; all fixtures aluminum rims—storage space for sliding table and aluminum cooking ware somewhere near the motor. Could same be built and sold on terms of a few hundred down and balance at stated intervals, or same as a house mortgage, at 5½ per cent interest? The writer abhors the stationary home idea, and wants a home on wheels for self, husband and son. Can draw the design, and have had it in mind for over ten years. Now please help me out with advice. Got no money to waste and want substantial returns for what I would spend. Don't like gasoline. Your esteemed reply would greatly oblige." It has been suggested that if this car de luxe should become a reality, it would make an excellent vehicle for an electric-light sales manager.

Efficiency Studies with Moving-Picture Camera.—At its Providence (R. I.) factory the New England Butt Company makes use of a moving-picture camera to analyze individual efficiency and eliminate waste motions from its workmen's routine tasks. With this camera photographic records are taken of the men at their work. Close by each laborer is a large clock, the hands of which revolve at the rate of one revolution in six seconds. The subdivisions of time intervals on the face of this clock are so minute that it is possible by a microscopic examination of the films to tell to within 0.0005 minute the time required for each motion or part of a motion. As a result, unnecessary effort has been eliminated by putting the worker's tools or materials within more convenient reach, enabling him to make more rhythmical motions and arranging his motions in more economic sequence. From practical experience with the moving-picture analysis, the company has found the time required for the manufacture of its goods cut by two-thirds, and even more; in one example from thirty to seven seconds.

* * *

Investigation of Explosion-Proof Motors.—The Bureau of Mines has been conducting an extensive investigation of explosion-proof motors, having reference to a type of motor inclosed by a casing so constructed that an explosion of mine gas—or methane—and air within the casing will not ignite a mixture of the same gas surrounding the motor. The results of this investigation have been published in Bulletin No. 46, prepared by Mr. H. H. Clark. There are two classes of explosion-proof motors, the first being totally inclosed and built strong enough to withstand high internal pressures, and the second a class provided with relief openings or valves designed to relieve the pressure of an internal explosion and to cool any products of combustion discharged through the valves. A satisfactory motor of the first class is more expensive than an equally safe motor of the second class, and therefore attempts to build explosion-proof motors have been largely confined to the latter type. Of the five protective devices submitted, one was rejected without test, one failed completely in test, and each of the others failed under one or more of the test conditions. One of the three devices last mentioned discharged flames in almost every test, another discharged only when the motor was running, while the third discharged no flames in any condition. Some weak point was found in each type of protection. Explosion-proof protective devices should be so designed that flames cannot be driven through them by an explosion of gas within the casing, and also so that coal dust cannot enter them or, if allowed to enter, cannot be discharged while ignited. Such devices should be very rugged in mechanical design or should be completely protected from injury. They should also be so constructed and applied to the motor that they cannot be detached from it without rendering the motor inoperative. The bureau states that it is prepared to make tests of explosion-proof motors for the purpose of establishing a "permissible list" of such machines, the schedule of charges for which may be obtained by applying to the director of the Bureau of Mines, Washington, D. C.

* * *

SOCIETY MEETINGS

Convention of the Canadian Electrical Association.—At a meeting in Toronto of the executive committee of the Canadian Electrical Association it was decided to hold the next annual convention in the twin cities of Port Arthur and Fort William on June 23, 24 and 25.

* * *

Electric Vehicle Association of America.—At the regular meeting of the Electric Vehicle Association of America to be held in New York on Feb. 25 Mr. James M. Skinner, of the Philadelphia Storage Battery Company, will give an illustrated talk on the Philadelphia thin-plate storage battery.

Columbia Electrical Society.—At a meeting of the Electrical Engineering Society of Columbia University to be held on Feb. 27 at 8.15 p. m. in the Engineering Building, 117th Street and Broadway, Mr. S. H. Blake, of the General Electric Company, will give an illustrated talk on "Arc and Theater Lighting."

* * *

New York Section, I. E. S.—A meeting of the New York Section of the Illuminating Engineering Society will be held in the Engineering Societies Building on March 13, in co-operation with the American Museum of Safety, the Society for the Conservation of Vision and the American Society of Mechanical Engineers.

* * *

Ladies' Day at Colorado Electric Club.—"Ladies' Day" was celebrated by the Colorado Electric Club on Feb. 13, with an attendance of 210 members and ladies. Hon. Helen Ring Robinson, Colorado State Senator from Denver, addressed the meeting on the subject of "American Democracy," and Mr. F. E. Watts, eleventh Jupiter of the Jovian Order, spoke of the growth and aims of his organization.

* * *

American Institute of Consulting Engineers.—At a dinner meeting of the American Institute of Consulting Engineers, to be held at the Engineers' Club, New York, on Tuesday evening, March 11, the general subject for discussion will be "Professional Relations." Outlines by Messrs. L. B. Stillwell and S. Whinery will form the basis of the discussion. Mr. Eugene W. Stern, 103 Park Avenue, New York, is secretary of the Institute.

* * *

Philadelphia Section, N. E. L. A., Activities.—At a meeting of the commercial branch of the Philadelphia Electric Company Section, National Electric Light Association, Jan. 27, Mr. William Foster, of the company's overhead department, presented a paper on "Service Estimates and Construction." The main section meeting for the month was held on Jan. 20 at the Franklin Institute, when Mr. Clarence Renshaw, Pittsburgh, Pa., spoke on "Modern Electric Railway Operation." As usual, a dinner at the New Bingham Hotel preceded the session. On Jan. 14 Mr. Arnold F. Meyers, of the local meter department, read a paper on the billing of customers, reading of meters, etc., before the accounting department branch. Steps have been recently taken toward forming another section branch to include the technical and engineering departments of the company. Mr. Thomas Sproule, past section chairman, was chosen temporary chairman, and Mr. A. L. Atmore secretary.

* * *

New York Companies' Section, N. E. L. A., Meeting.—About 400 were present at the meeting of the New York Companies' Section on Feb. 17 to hear Mr. J. W. Lieb, Jr., of the New York Edison Company, discuss the question of "Rates." The meeting was opened by Dr. W. H. Tolman, who presented an illustrated lecture on "How to Prevent 50 Per Cent of Industrial Accidents." After Dr. Tolman's talk Mr. Joseph Becker, chairman of the section, presented Mr. Lieb. Several charts and graphics had been prepared and were used during the course of Mr. Lieb's lecture to point out the rather interesting analogies between electric-lighting plant costs and railroad costs when put into comparable terms. The fact was clearly brought out that the law does not prohibit and never has prohibited discriminatory rates. It is only when these discriminatory rates become unjust, unreasonable and disproportionate to the consumers that the law prohibits them. Mr. Lieb then explained in detail the system of rates now used by the New York Edison Company. Previous to the meeting a dinner was given to Mr. Lieb at Louis Martin's restaurant.

Electrical Equipment of a Modern Building

Isolated 500-kw generating plant for the Aeolian Hall, New York—Wiring for feeder and distribution system—Illumination of concert hall, exhibition rooms and offices

ONE of the latest additions to the rapidly increasing number of high-class office buildings in New York is the Æolian Hall, located on Forty-second and Forty-third Streets, between Fifth and Sixth Avenues and facing Bryant Park. This building has seventeen floors above the street level and extends two below the street. The first four floors and the basement are used by the Æolian Company as sales and exhibition rooms, while the executive offices of the company occupy the fifth floor. The upper floors are public offices and lofts.

The greater part of the first and second floors is occupied by an auditorium or exhibition hall, with a seating capacity of 1380 and provided with a large and handsomely decorated stage. The entrance to this hall is from Forty-third Street. On the main floor at Forty-second Street is the Æolian Company's reception room, which is connected with the floor above by a broad marble staircase and has three elevators running to the fifth floor for the exclusive service of the Æolian Company and its patrons.

Power Plant

Energy for lighting and motor service in the building is produced in a private generating plant installed in the sub-basement on the Forty-third Street side of the building. The boiler-room equipment consists of three Babcock & Wilcox boilers, each rated at 300 boiler-hp, which are separated by 5-ft. aisles. Coal is stored in a large vault beneath the sidewalk, whence it is carried on a small railroad to the boiler room. The ashes are removed in cans and raised by an electrically operated lift to the sidewalk.

In the boiler room there are also a storage tank, filter and pumps for the oiling system of the engines and generators. This oiling system is the "Richardson central system" and was installed by the Peterson Engineering Company. The sump pit is below the boiler room and is provided with two pumps and auxiliary apparatus.

The generating equipment consists of three units—one 160-hp simple horizontal Corliss engine, directly connected to a 100-kw Crocker-Wheeler three-wire, 120-240-volt generator, and two 310-hp simple horizontal Corliss engines, directly connected to 200-kw Crocker-Wheeler three-wire generators. The engines were built by the C. & G. Cooper Company of Mount Vernon, Ohio, and are equipped with separate eccentrics for steam and exhaust valves and releasing valve gear. The speed of all units is 120 r.p.m. The engines operate non-condensing, the back pressure being very small. The steam pressure at the throttle is approximately 120 lb.

Each unit is equipped with an electric engine stop and speed-limit device. The latter device is mounted on an iron pedestal near the generator and connected to the engine shaft by a small belt. There are two push-button boards for stopping the engines. One is located in the office of the chief engineer and the other is mounted on a column in the center of the engine room conveniently in reach in case of danger. These safety devices are made

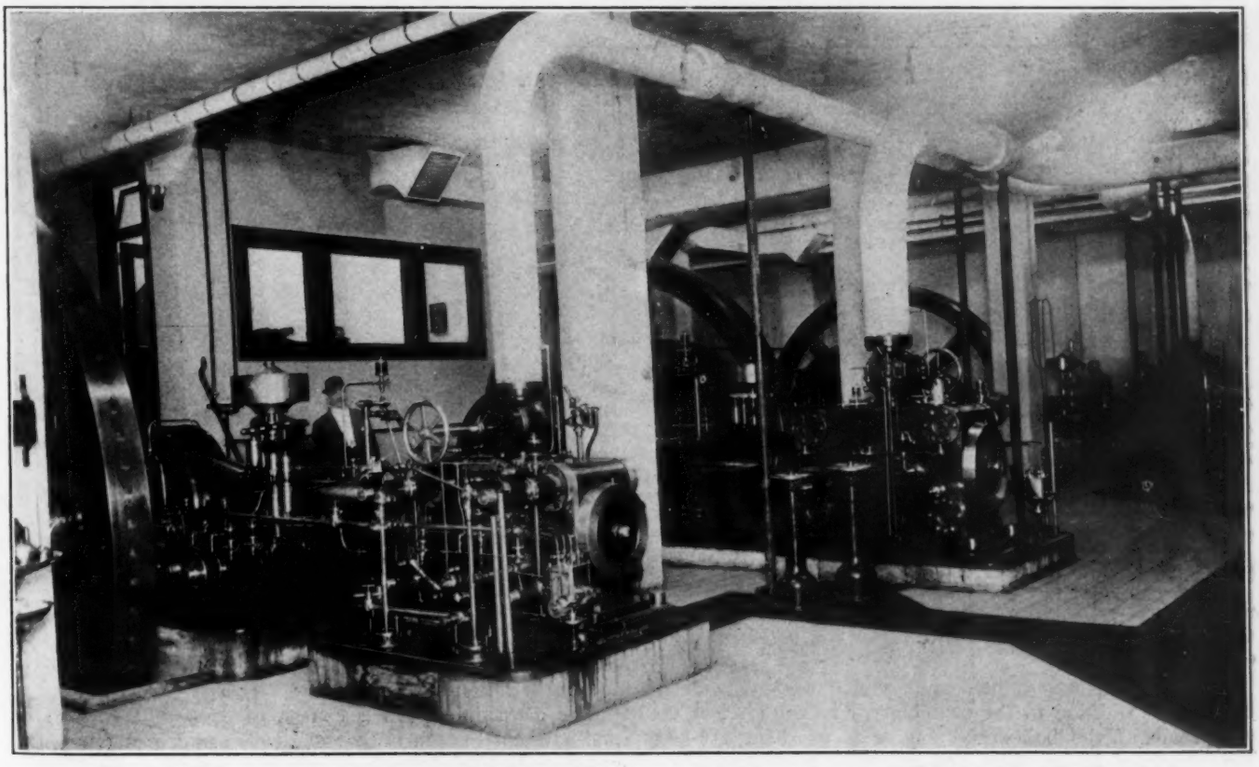


FIG I—GENERATING ROOM OF ÆOLIAN HALL POWER PLANT

and installed by the Locke Manufacturing Company, of Salem, Mass.

The cables from the generators to the switchboard are run in galvanized-iron conduits placed under the engine-room floor. The conduits terminate in brick-lined pits at the generator and switchboard. The cables have special rubber insulation and are lead-covered.

The switchboard consists of three generator panels, two motor panels and three lighting panels. The board proper is of 3-in. gray Tennessee marble. On the panels for the 200-kw generators are mounted a 1200-amp I-T-E circuit-breaker, a 1000-amp four-pole knife switch for motor service, a 1000-amp four-pole knife switch for lighting, a 1000-amp single-pole switch for the neutral, and two 1200-amp Weston ammeters, one in each outside conductor. The panel for the 100-kw generator has the same equipment of switches and meters but of one-half the rating of those of the other panels. Each panel is also equipped with ground detector, rheostat, pilot lamp and Weston watt-hour meters.

On the motor panels are mounted double-pole feeder switches, a Weston ammeter and a Columbia watt-hour meter. On the lighting panels are mounted three-pole feeder switches, two Weston ammeters, one in each leg, and a Columbia three-wire watt-hour meter.

Over the switchboard are mounted two iron pull boxes in which the feeder conduits terminate. From the pull boxes the feeder cables pass through bushed holes down to the lugs on the switchboard extension bars. The sides and top of the switchboard are inclosed with an iron grill. In front of the switchboard, supported from brackets, is a Frink reflector running the length of the board. The main switchboard and all the cut-out panels are manufactured by the Metropolitan Electric Manufacturing Company of Brooklyn.

The engine room is lighted by fourteen 100-watt tungsten fixtures, in addition to the switchboard reflector. For the ventilation of the boiler and engine room there are two fans operated by an 8-hp and a 2.5-hp Diehl motor respectively. A large Sturtevant ventilating fan, driven by a 14-hp Diehl motor, supplies fresh filtered air to certain offices in the building and also for the engine room. A vacuum-cleaning plant, made by the Connersville Manufacturing Company, of Connersville, Ind., operated by a General Electric 15-hp interpole motor, is installed on the mezzanine floor. There are also two water filters and accessories made by the Roberts Manufacturing Company, of Philadelphia, Pa., and two Worthington steam-driven pumps for circulating the water. A high-pressure house pump and an interconnected high-pressure fire pump, made by the Worthington Pump Works, complete the equipment.

Distribution System

The system of distribution of energy for lighting and motor service consists of thirty-four feeders from the switchboard in the engine room terminating at the distribution panels on the floors above. There are three rising points for these feeders shown on the feeder sheet and

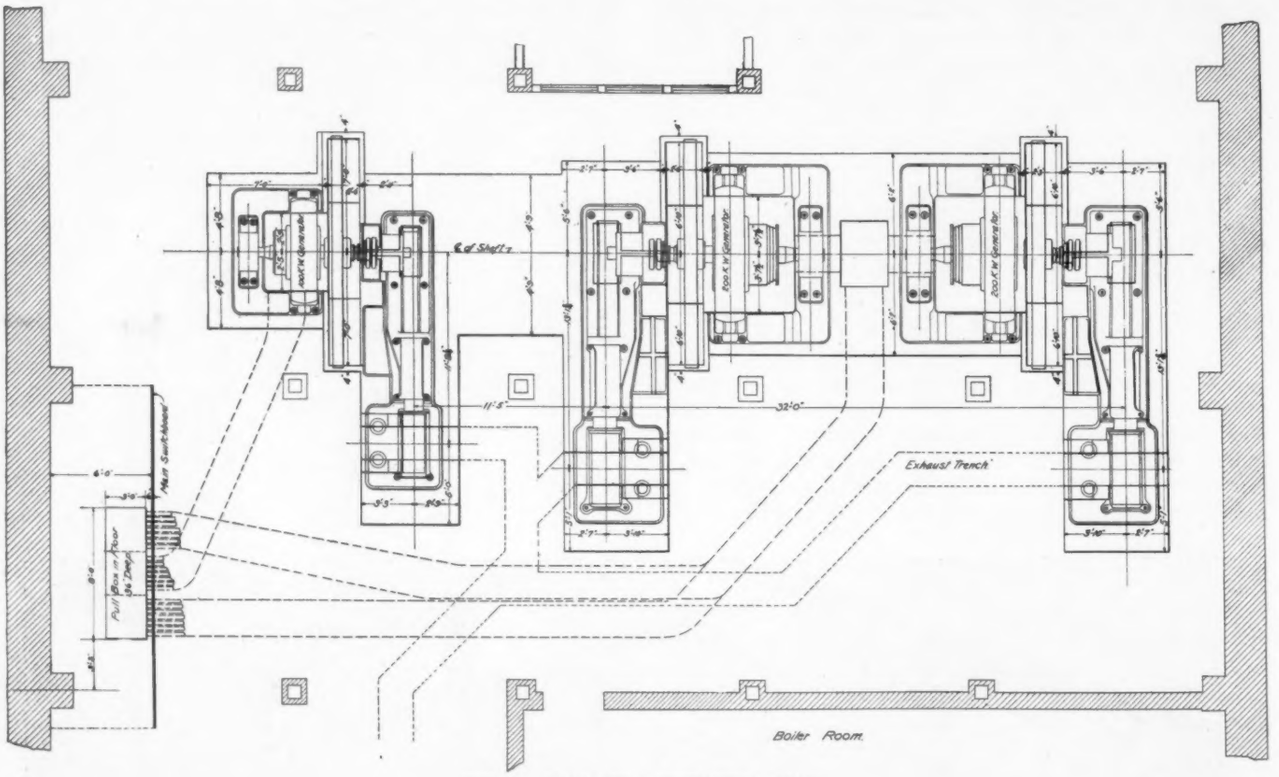


FIG. 2—PLAN OF GENERATING ROOM

designated as *A*, *B* and *C*. The feeders marked *A* terminate in the panels on the Forty-second Street side of the building on the floors from the basement to the sixth floor. The feeders marked *C* terminate in the panels on the seventh, tenth, thirteenth and sixteenth floors. Each of the panels on these floors is provided with two sub-main switches which control sub-feeders to panels on the floors below and above. These panels control the branch circuits for the office lighting on the south end of the building. Feeders rising at point *C* also terminate in panels on the eighth, thirteenth and sixteenth floors with sub-feeders to panels on the two floors below and to two floors above. These panels control the branch circuits for stair, corridor and toilet lighting, and are located in the same boxes as the panels for the office lighting. The same general scheme is followed for the feeders rising at point *B*, for panels at the north side of building.

The distribution panels consist of 220-volt feeder buses and 110-volt branch buses, all of 98 per cent conductivity copper. In each branch circuit is a 10-amp fused "baby" knife switch. The fuses are of the inclosed type held in

spring clips. Each panel has a compartment for push-button switches which control the circuits for the corridor lighting. All copper is highly polished and mounted on a 7/8-in. slate base, the latter being inclosed by slabs of 5/8-in. marbleized slate. The panels are inclosed in sheet-steel cabinets, with an inner metal door and trimming and an outer door and trim of steel, the finish of the latter conforming in color and design to the interior finish of each floor. Each panel is provided with a testing lamp, a fuse box and a directory that indicates the circuits that the "baby" knife switches and push-button switches control. On the office floors there is an average of thirty-six circuits, each one supplying from three to six outlets. Two of the feeders terminate in panels on the roof, one at each end of the building. These panels contain twenty branch circuits each and are intended for special illumination on the roof to be installed at a future date.

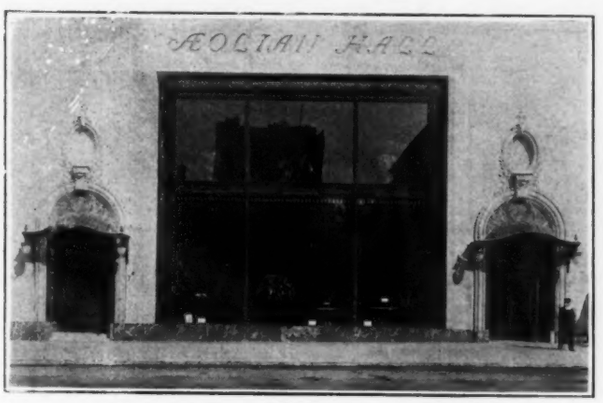


FIG. 3—FORTY-SECOND STREET ENTRANCE

ILLUMINATION

Of particular interest is the illumination of the auditorium. The general lighting of this hall is obtained from nine sources in the arched ceiling. Along the center of the ceiling there are three cone-shaped fixtures, each one containing forty 40-watt tungsten lamps, behind sectors of heavily etched "silver ripple" glass. These fixtures are supported by angle-iron frames and are raised and lowered by means of windlasses fastened to the angle-iron support. A trap-door in the floor above each fixture gives access to the windlass.

To provide for disconnecting of the fixture circuits before lowering the fixture, a receptacle and insertion plug have been provided for each circuit and placed within easy reach beneath the trap-door. Six other lighting fixtures are recessed into the ceiling, three on each side of the center fixtures. For each one a cylindrical metal box 30 in. in diameter is set into the ceiling, the lower edge of which is about 6 in. above the surface of the ceiling, the opening providing a passage for air to the ventilating ducts, which are also located above the ceiling.

FIG. 5—ILLUMINATION AT ENTRANCE

In each of these boxes are installed thirteen 100-watt tungsten lamps spaced about 8 in. apart. The interior of the box is painted white. Below the lights there is a heavily etched "silver ripple" glass diffuser. By this arrangement is obtained a large surface of evenly distributed light of high intensity providing good general illumination in the auditorium. Above the balcony on each side of the auditorium are horizontal cove reflectors so placed and designed as to throw the light up to the ceiling, from which it is reflected to the balcony and main floor. These reflectors are the "Linolite" type, made by the H. W. Johns-Manville Company, and contain 25-watt tungsten lamps connected four in series. An unusual lighting effect has been secured in this auditorium by installing "Linolite" reflectors along the edge of the balcony below the railing in a small cove especially designed for this purpose. This cove is covered with an etched glass of deep pink color. The reflector is so designed as to throw the soft pink-colored light directly upward onto the face of a person leaning over the balcony. These reflectors also contain 25-watt tungsten lamps connected four in series.

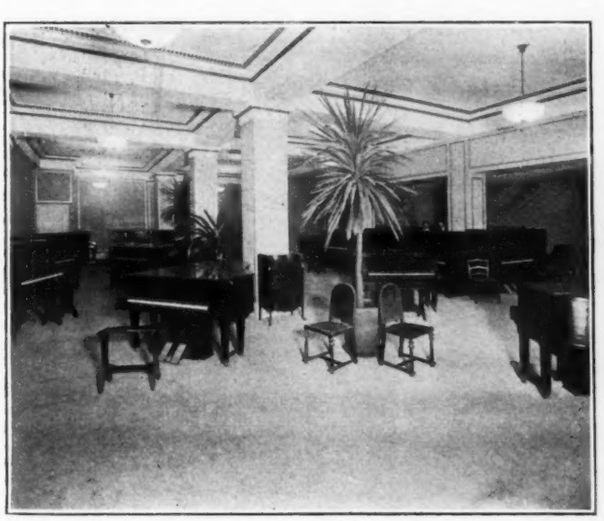
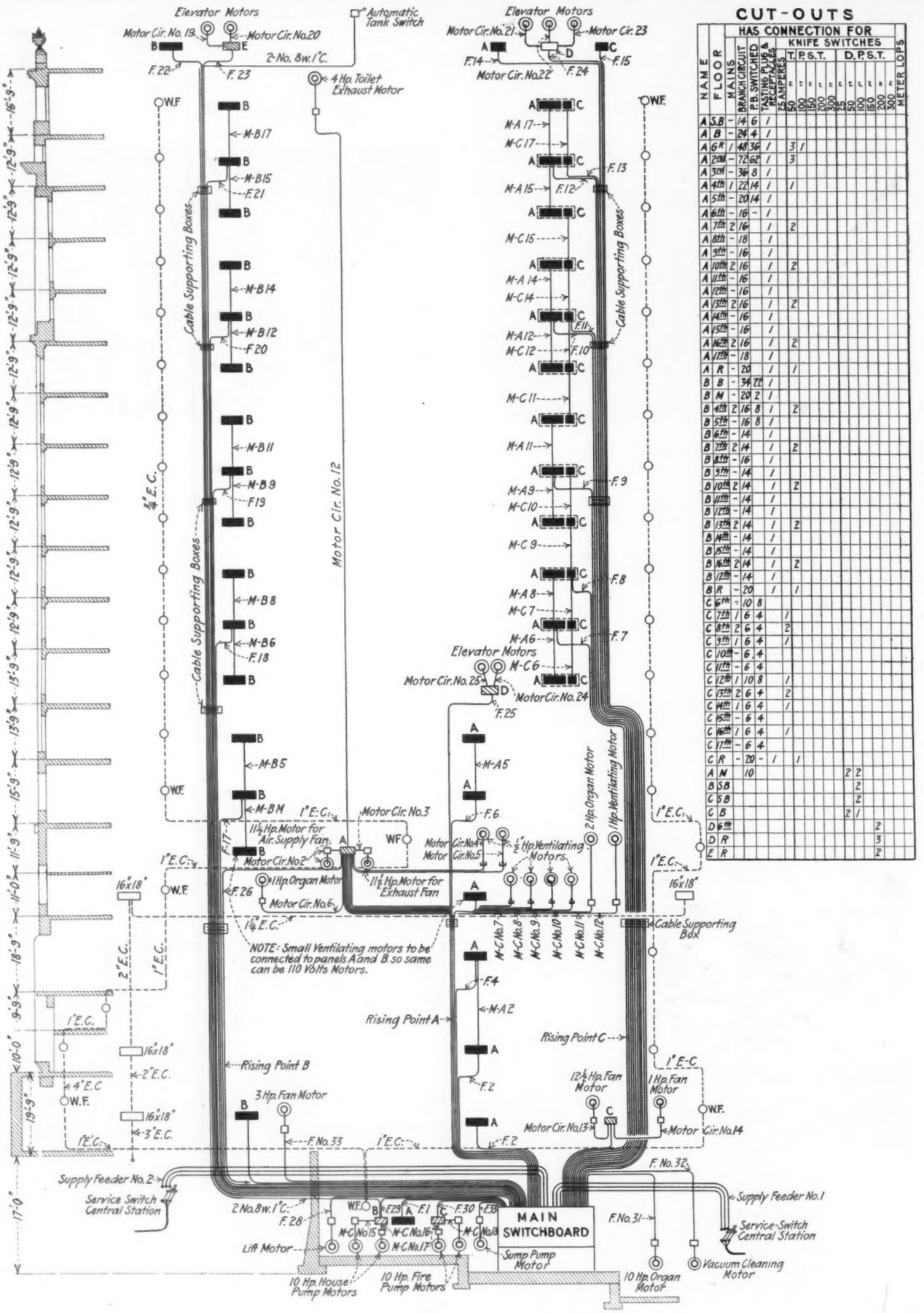


FIG. 4—EXHIBITION ROOM ON SECOND FLOOR

FIG. 6—EXHIBITION ROOM IN BASEMENT



CUT-OUTS

NAME	FLOOR	MAINS	BRANCH CIRCUIT	P.B. SWITCHED	HAS CONNECTION FOR KNIFE SWITCHES T.P.S.T. TASTING PLUG & RECEPTACLES 25 AMPERES	T.P.S.T. 50	T.P.S.T. 100	T.P.S.T. 150	T.P.S.T. 200	T.P.S.T. 300	D.P.S.T. 25	D.P.S.T. 50	D.P.S.T. 100	D.P.S.T. 150	D.P.S.T. 200	D.P.S.T. 300	METER LOPS
A	S.B	-	14	6	1												
A	B	-	24	4	1												
A	6th	1	48	36	1	3	1										
A	2nd	-	72	62	1	3											
A	3rd	-	36	8	1												
A	4th	1	22	14	1	1											
A	5th	-	20	14	1												
A	6th	-	16	-	1												
A	7th	2	16		1	2											
A	8th	-	18		1												
A	9th	-	16		1												
A	10th	2	16		1	2											
A	11th	-	16		1												
A	12th	-	16		1												
A	13th	2	16		1	2											
A	14th	-	16		1												
A	15th	-	16		1												
A	16th	2	16		1	2											
A	17th	-	18		1												
A	R	-	20		1	1											
B	B	-	34	22	1												
B	M	-	20	2	1												
B	4th	2	16	8	1	2											
B	5th	-	16	8	1												
B	6th	-	14		1												
B	7th	2	14		1	2											
B	8th	-	16		1												
B	9th	-	14		1												
B	10th	2	14		1	2											
B	11th	-	14		1												
B	12th	-	14		1												
B	13th	2	14		1	2											
B	14th	-	14		1												
B	15th	-	14		1												
B	16th	2	14		1	2											
B	17th	-	14		1												
B	R	-	20		1	1											
C	6th	-	10	8													
C	7th	1	6	4	1												
C	8th	2	6	4	2												
C	9th	1	6	4	1												
C	10th	-	6	4													
C	11th	-	6	4													
C	12th	1	10	8	1												
C	13th	2	6	4	2												
C	14th	1	6	4	1												
C	15th	-	6	4													
C	16th	1	6	4	1												
C	17th	-	6	4													
C	R	-	20	-	1	1											
A	N		10								2	2					
B	S.B											2					
C	S.B											2					
C	B										2	1					
D	6th												2				
D	R												3				
E	R												2				

FIG. 7—DIAGRAM SHOWING FEEDER SYSTEM

OUTLETS AND SYMBOLS

LOCATIONS	CEILING CHANDE. ✧	REFLECTOR UNIT ◆	RECEPTACLE LIGHT ●	DROP CORD ○	WALL BRACKET ⚲	GOOSENECK BR'T ⚲	INSERTION PLUG ≋	FLOOR PLUG ●	STEREOPTICON P'LG ●	WALL EXTENSION ⚲	AUTO. DOOR SW. ▲	P.B. SWITCH F	EXIT LIGHT ⊕	JUNCTION BOX ■	POWER PLUG ▣	CEILING EXTENSION ✧	CALL BELL ☐	TEL. WALL TYPE ☐	TEL. DESK TYPE ⊕	SERVICE BOX ○	FLOOR OUTLET FOR TEL. ●	WATCHMAN & FIRE ALARM STATION ○WF
Roof		3			4					2		3							S			
17th Floor	30	14		3	6		59					3										2
16th "	31	14		1	6		58					3										2
15th "	31	15		1	6		58					4										2
14th "	31	14		1	6		58					3										2
13th "	31	14		1	6		58					3										2
12th "	31	15		1	6		58					4										2
11th "	31	14		1	6		58					3										2
10th "	31	14		1	6		58					3										2
9th "	31	15		1	6		58					4										2
8th "	36	14		1	6		58					8		5								2
7th "	31	14		1	6		58					3										2
6th "	30	14		1	6		58					3										2
5th "	44	7		1	12		13					11			2	3		2				2
4th "	44	7		1	12		13					11			2	3		2				2
3rd Fl. Mezza	1	25	9		8							17			8			1				2
3rd Floor	21	38	2	5	14		13	1				33		2	18			1	5			1
2nd "	27	6	5		15	1	2		1	2	1	11	4		4	1			2			1
Ground Fl. Mezza																						1
" Floor	13	4	62	4	2		1			12		10	6	3	4	5	2	2				2
Basement	27	57	92	2	22	2	10			1		62			17		1	4		16	2	2
Sub-Bas. Mezza																						
Sub-Basement		28	15	9			7					14						1				1
Total	552	346	185	36	151	3	756	1	1	17	1	216	10	10	55	12	3	13	7	16	2	38

MOTOR CIRCUITS

NUMBER	SERVICES FOR SUPPLYING CURRENT TO	HP. SUPPLIED	LENGTH IN FT. (ONE WAY)	CURRENT IN AMP.	SIZE OF WIRE	MINIMUM INSIDE DIAM. OF CONDUIT ALLOWED
1	Toilet Exh. Fan	4	250	16	No. 8	1"
2	Air Supply Fan	11½	35	46	No. 4	1¼"
3	Exhaust Fan	11½	40	46	No. 4	1¼"
4	Vent. Motor	½	100	2	No. 14	½"
5	" "	½	90	2	No. 14	½"
6	Organ Motor	1	70	4	No. 14	½"
7	Vent. Motor	½	125	2	No. 14	½"
8	" "	½	125	2	No. 14	½"
9	" "	½	110	2	No. 14	½"
10	" "	½	110	2	No. 14	½"
11	Organ Motor	2	180	8	No. 10	¾"
12	Vent. Motor	1	160	4	No. 14	½"
13	Fan Motor	12½	25	50	No. 3	1¼"
14	" "	1	110	4	No. 14	½"
15	Housepump M.	10	30	40	No. 4	1¼"
16	" "	10	35	40	No. 4	1¼"
17	Fire Pump Motor	10	30	40	No. 4	1¼"
18	" " "	10	35	40	No. 4	1¼"
19	Elevator Motor	40	25	160	No. 4/0	2"
20	" "	35	25	140	No. 4/0	2"
21	" "	35	25	140	No. 4/0	2"
22	" "	35	25	140	No. 4/0	2"
23	" "	35	25	140	No. 4/0	2"
24	" "	35	25	140	No. 4/0	2"
25	" "	35	25	140	No. 4/0	2"

LIGHTING MAINS

NUMBER	SUPPLIED BY: FEEDER	CUT-OUT	FLOOR	BRANCH CIR'S	ESTIMATED LOAD IN AMP.	LENGTH IN FT. (ONE WAY)	LOSS IN VOLTS ON EACH SIDE	SIZE OF WIRE: MIDDLE CONDUCTOR	SIZE OF WIRE: OUTSIDE CONDUCTOR	MINIMUM INSIDE DIAMETER OF CONDUIT ALLOWED
A5	6	A	4th	20	50	17		No. 4	No. 4	1½"
A6	7	A	7th	16	40	15		No. 6	No. 6	1¼"
A8	7	A	7th	18	45	15		No. 6	No. 6	1½"
A9	9	A	10th	16	40	15		No. 6	No. 6	1¼"
A11	9	A	10th	16	40	15		No. 6	No. 6	1¼"
A12	10	A	13th	16	40	15		No. 6	No. 6	1¼"
A14	10	A	13th	16	40	15		No. 6	No. 6	1¼"
A15	12	A	16th	16	40	15		No. 6	No. 6	1¼"
A17	12	A	16th	18	45	15		No. 6	No. 6	1½"
BM	17	B	4th	20	50	15		No. 5	No. 5	1¼"
B5	17	B	4th	16	40	16		No. 6	No. 6	1¼"
B6	18	B	7th	14	35	15		No. 6	No. 6	1¼"
B8	18	B	7th	16	40	15		No. 6	No. 6	1¼"
B9	19	B	10th	14	35	15		No. 6	No. 6	1¼"
B11	19	B	10th	14	35	15		No. 6	No. 6	1¼"
B12	20	B	13th	14	35	15		No. 6	No. 6	1¼"
B14	20	B	13th	14	35	15		No. 6	No. 6	1¼"
B15	21	B	16th	14	35	15		No. 6	No. 6	1¼"
B17	21	B	16th	14	35	15		No. 6	No. 6	1¼"
C6	8	C	8th	10	25	15		No. 8	No. 8	1"
C7	8	C	8th	16	40	15		No. 6	No. 6	1¼"
C9	8	C	8th	12	30	15		No. 8	No. 8	1"
C10	8	C	8th	6	15	15		No. 10	No. 10	1"
C11	11	C	13th	6	15	15		No. 10	No. 10	1"
C12	11	C	13th	16	40	15		No. 6	No. 6	1¼"
C14	11	C	13th	12	30	15		No. 8	No. 8	1"
C15	11	C	13th	6	15	15		No. 10	No. 10	1"
C17	13	C	16th	6	15	15		No. 10	No. 10	1"
A2	3	A	6th Fl.	40	100	28		No. 0	No. 0	2"

LIGHTING FEEDERS

NUMBER	TERMINATES AT: FLOOR	CUT-OUT	BRANCH CIR'S	ESTIMATED LOAD IN AMP.	LENGTH IN FT. (ONE WAY)	LOSS IN VOLTS ON EACH SIDE	SIZE OF WIRE: MIDDLE CONDUCTOR	SIZE OF WIRE: OUTSIDE CONDUCTOR	MINIMUM INSIDE DIAM. OF CONDUIT ALLOWED
1	S-B	A	14	35	80	2.3	No. 6	No. 6	1"
2	B	A	24	60	140	3.5	3	3	1½"
3	6	A	48	120	155	2.4	000	000	2½"
4	2nd	A	72	180	180	2.8	250 000	250 000	2½"
5	3rd	A	36	90	190	2.3	00	00	2½"
6	4th	A	42	105	210	2.8	000	000	2½"
7	7th	A	50	125	260	3.5	00	00	2½"
8	8th	C	34	85	250	2.5	00	00	2½"
9	10th	A	48	120	305	3.2	000	000	2½"
10	13th	A	48	120	350	3.5	000	000	2½"
11	13th	C	34	85	350	2.5	000	000	2½"
12	16th	A	50	125	395	3.4	0000	0000	2½"
13	16th	C	12	30	395	2.5	2	2	2"
14	R	A	20	50	440	3.6	00	00	2½"
15	R	C	20	50	500	4.	00	00	2½"
16	B	B	34	85	120	3.3	2	2	2"
17	4th	B	42	105	200	3.4	00	00	2½"
18	7th	B	44	110	250	3.	00	00	2½"
19	10th	B	42	105	295	3.3	00	00	2½"
20	13th	B	42	105	340	3.1	000	000	2½"
21	16th	B	42	105	390	3.5	000	000	2½"
22	R	B	20	50	415	3.3	00	00	2½"

POWER FEEDERS

NUMBER	TERMINATES AT	HP. SUPPLIED	ESTIMATED LOAD IN AMP.	LENGTH IN FT. (ONE WAY)	LOSS IN VOLTS ON EACH SIDE	SIZE OF WIRE	MINIMUM INSIDE DIAMETER OF CONDUIT ALLOWED
23	E. Roof	75	300	415		No. 500,000	3"
24	D. Roof	105	420	440		600 000	3"
25	D. 6th Floor	70	280	260		400 000	3"
26	A. Mezza	34	136	240		00	2"
27	C. Basement	13½	54	135		2	1½"
28	Lift Motor	12½	50	125		2	1½"
29	House Pump	20	80	45		2	1½"
30	Fire Pump	20	80	96		2	1½"
31	Organ Motor	10	40	100		4	1¼"
32	Vacuum Clean.			55		4	1¼"
33	Sump Pump			90		8	1"

SUPPLY FEEDER

NUMBER	ESTIMATED LOAD IN AMP. AT 240 VOLTS	NUMBER OF CONDUCTORS	SIZE OF EACH CONDUCTOR	NUMBER OF CONDUITS	MINIMUM INSIDE DIAMETER OF CONDUIT ALLOWED	ESTIMATED LENGTH IN FT. (ONE WAY)
1	2000	6	No. 2,000,000	6	3½"	200'
2	2000	6	No. 2,000,000	6	3½"	140'

FIG. 8—SPECIFICATIONS FOR FEEDER SYSTEM

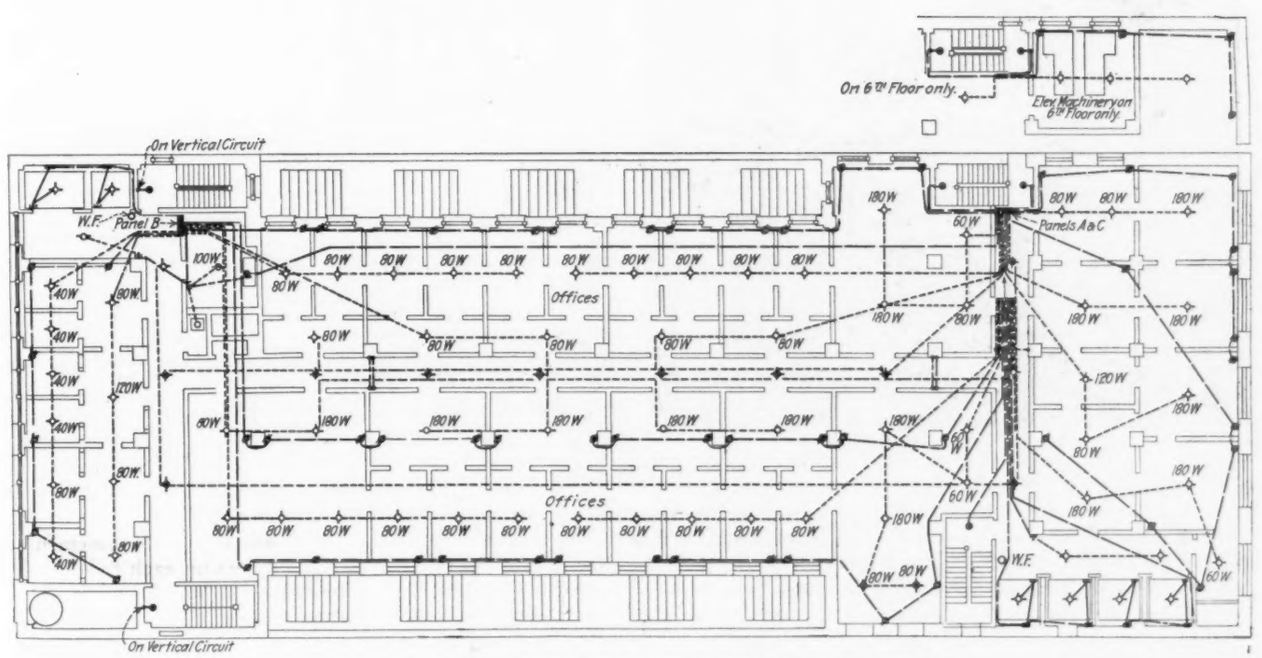


FIG. 9—TYPICAL FLOOR PLAN SHOWING DISTRIBUTION SYSTEM

A long graceful arch, divided up into a number of square open panels, spans the entire stage. Over each panel is placed a square metal frame that is divided into four smaller squares, into which etched "silver ripple" glass is inserted. Between the metal frames and the arch proper a 1-in. air space is provided for ventilation and as an exit for the sound waves from the organ echo chambers above.

Above the center of each four panels is placed a Norbitt receptacle in a condulet outlet box. Each receptacle is fitted with a 100-watt tungsten lamp and a 12-in. Frink corrugated reflector. The tip of the lamp is 36 in. above the surface of the glass. The conduit and outlet boxes are all supported on angle-iron framework secured to the floor beams above. This method of illumination provides a well-distributed and even lighting effect on the stage.

At times a very strong light on the stage is desirable, and for this purpose three silk canopy fixtures have been suspended from the arched ceiling at a height of 10 ft. above the stage. Each one of these fixtures consists of a Benjamin cluster of eight 100-watt tungsten lamps. To increase further the stage illumination a 16-ft. vertical Frink reflector has been provided each side of the stage.

The rear of the balcony is lighted from a number of three-arm brackets, each arm being equipped with a 60-watt lamp with a round frosted bulb. Under the balcony there are eight hemisphere ceiling fixtures, each containing five 20-watt lamps.

The entrance lobby is lighted from three shallow hemisphere ceiling fixtures, each containing two 40-watt tungsten lamps. Over the entrance to the hall is a massive marquise extending along the full width of the building and out to the edge of the sidewalk. Along the outer edge of the marquise there are ninety-six 15-watt tungsten lamps spaced 9 in. apart. Each lamp is supported from a Russell & Stoll heavy-brass waterproof outlet box and receptacle and inclosed in an "Opalux" bowl. Over each door in the auditorium is an exit lamp in a regulation box. The circuits for these exit lamps are run directly to the switchboard in the sub-basement.

The lighting of the auditorium and stage is controlled from a special panel placed in a small passage to the east of the stage. This panel is divided into seven sections, as follows: Section 1, controlling lighting behind the stage,

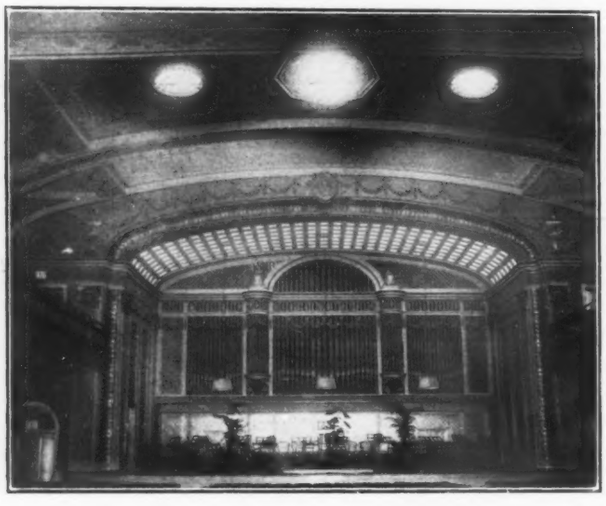


FIG. 10—STAGE IN CONCERT HALL

on the organ loft and for the stereopticon; section 2, controlling ceiling lamps in auditorium; section 3, controlling cove reflector lamps; section 4, controlling balcony reflector lamps; section 5, controlling stage lighting; section 6, controlling lamps under the balcony; section 7, controlling vestibule lamps.

Each of the above sections is controlled by knife switches in addition to the "baby" knife switches controlling the individual circuits, with the exception of section 1, which is connected below the main switch. The opening of this switch extinguishes all lamps in the auditorium except the exit lamps, the lamps behind the stage and those for the stereopticon. For dimming effects the baby knife switches in the various sections are opened.

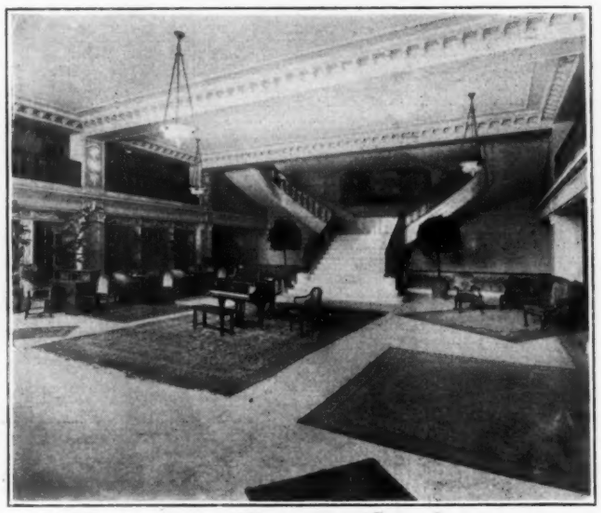


FIG. 11—RECEPTION ROOM ON MAIN FLOOR

The basement floor is used for demonstration of talking machines and pianolas and is divided into a main reception room and a number of individual music rooms. The lighting of the main portion of this floor is from three ceiling chandeliers, each containing four 60-watt lamps with "Opalux" shades and six ceiling hemisphere fixtures with frosted glass globes. The individual music rooms are lighted by a single hemisphere ceiling fixture similar to those in the main room. Each music room has a wall plug for additional lighting or for operating the organ motors.

The large reception room on the main floor facing Forty-second Street is lighted by means of four semi-indirect ceiling fixtures of white alabaster suspended by three heavy chains. The lighting of the second floor showroom is practically the same as that of the reception room. The third floor is decorated entirely in light blue and gold, and the fourth floor in a dark red and gold. The lighting on both floors is semi-indirect from hemisphere alabaster bowls suspended from the ceilings by chains. The lighting of the ordinary office is by ceiling fixtures with two and three arms, each arm supporting a 40-watt or 60-watt tungsten lamp and an "Opalux" shade. Pendent switches are used.

The lighting of the corridors is by straight-stem fixtures, each equipped with a 40-watt tungsten lamp and an "Opalux" shade. Each office is provided with one or two insertion plugs located in the wall 18 in. above the floor.

Elevators and Miscellaneous Electrical Devices

The building is provided with three sets of elevators, of which one set of three cars on the east side of the building at Forty-second Street runs only to the fifth floor. On the West Forty-second Street side a set of four elevators serves all floors. At the Forty-third Street side one passenger car and one freight car travel from the basement to the top floor. All the passenger elevators are of the Otis one-to-one direct-traction type and the freight elevator is of the worm-gear type.

The ventilation of the building is well provided for by forced draft from the ventilating fans in the sub-basement and is supplemented by electric ozonators on each floor.

An interesting feature is the control of the organ in the auditorium. The organ bellows, which are operated by

two 5-hp motors, are located on the mezzanine floor of the engine room. These motors can be started or stopped from the auditorium stage by means of two push-button switches. These switches are so connected that either may be used to start or stop the motors. When the upper button is pressed a circuit is established that operates a relay in the organ motor rooms. This relay closes the motor circuits

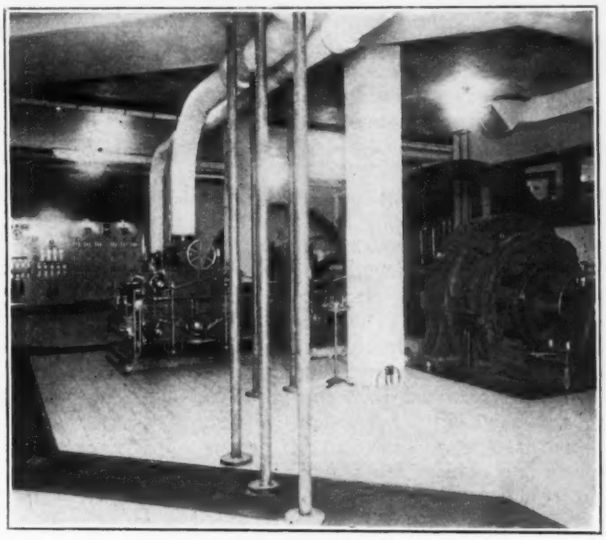


FIG. 12—INTERIOR OF ENGINE ROOM

and at the same time a small pilot lamp in the passageway at the east side of the stage is switched on which indicates that the motors are running.

Over the marquise at the Forty-third Street entrance is placed on a heavy iron bracket a carriage-call device manufactured by the Woodruff Carriage Call Company. This carriage call is electrically operated from a small push-button board inserted in the wall at the middle entrance.

The entire electrical equipment was designed by C. O. Mailloux and C. E. Knox, consulting electrical engineers, 90 West Street, New York City. The architects for the building are Warren & Wetmore, 16 East Forty-seventh Street, New York City. Most of the electrical installations were made by the Lord Electric Company. Mr. R. A. Foster is snperintendent and Mr. J. W. Roberts chief engineer of the building.

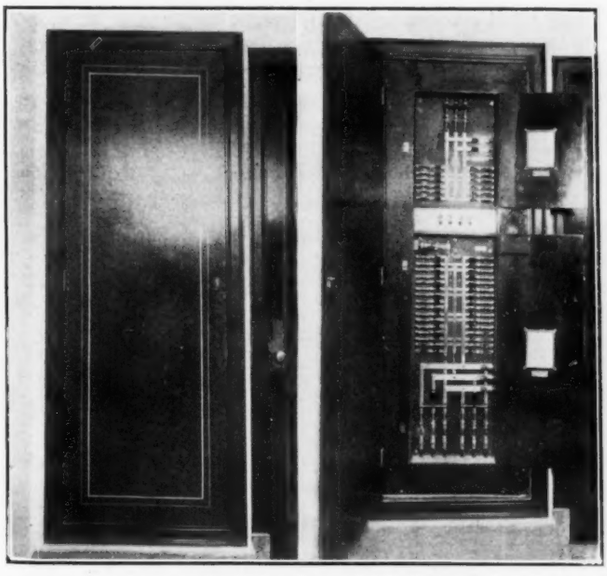


FIG. 13—TYPICAL FLOOR DISTRIBUTION BOX

Precipitation of Smoke and Suspended Dust by Electrostatic Methods

By H. N. Holmes

The public is beginning to demand a rigid control of the dust issuing from the rotary kilns of Portland-cement plants, of smoke from factories and of acid fumes from smelters. In England it is even interested in removing the excessive fog from the atmosphere.

All this may be done with excellent success in some cases by the magic of the electric discharge. The principle of this process is easily illustrated. Suppose a metallic point be placed near a smooth sheet of metal and a silent electric discharge be passed across the gap. The air particles will have the same charge as the point and will be repelled from it in a miniature wind. If the air be laden with floating dust, the charged or ionized gas particles will strike these dust motes and give them their own charge, causing the dust to be deposited on the opposite electrodes and thus clearing the gas. Of course, a direct-current charge of high potential is understood in the above experiment.

In England Sir Oliver Lodge worked for some time experimenting with the effect of Hertzian waves on fog. His idea was that the minute particles of moisture upon

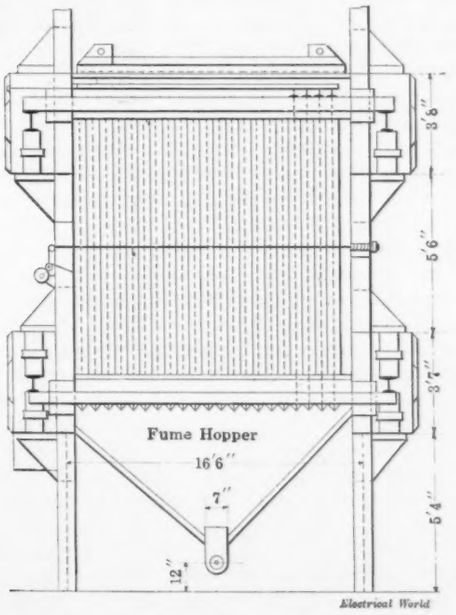


FIG. 1—SECTION THROUGH PRECIPITATING UNITS

becoming electrically charged would collect in drops large enough to fall to the earth. There is some hope that success may ultimately be achieved in these experiments.

In America Dr. F. G. Cottrell, of the United States Bureau of Mines, has advanced this principle largely in catching the Portland-cement dust from rotary kilns, and in removing dust and acid fumes from smelter gases. In the average kiln of this type, 100 ft. long and 7 ft. in diameter, there is a volume of stack gas totaling 50,000 cu. ft. per minute and carrying four or five tons of dust per day of twenty-four hours. The Cottrell method uses two forms of electrodes in the stack—the discharge electrodes, between which leaps a heavy discharge to ionize the gases and ultimately the dust particles, and the collecting electrodes, so arranged that, while no discharge takes place, a powerful electrostatic field is formed in which the ionized particles migrate and are deposited on the electrodes. The two forms of electrodes are alternated across the apparatus with an electrode spacing of 2 in. to 6 in. In the plant of the Riverside Portland Cement Company the "treater" has a cross-section 12 ft. by 16 ft., with

a length of 20 ft. The dust is removed from the electrodes every three or four hours by mechanical shaking. Such a treater consumes 7 kw-hr. per day, including energy for the motors. A 5000-barrel mill would use about 75 kw-hr. per day.

The Raritan Copper Works, of Perth Amboy, N. J., have used this process in the treatment of their slimes from

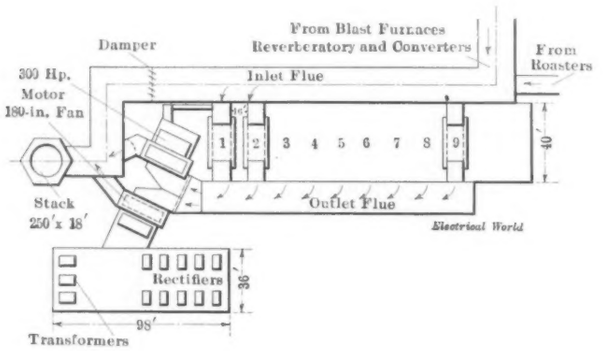


FIG. 2—GENERAL ARRANGEMENT OF PRECIPITATING PLANT

the electrolytic baths. These slimes contain gold, silver, arsenic, antimony, selenium and other elements. Generally this slime is roasted in a furnace and the volatile elements are driven off and condensed in the flue. However, this separation is not satisfactory when gravity alone is depended upon as the settling agent. Some of the fumes have even been collected after passing through water scrubbers and been found to contain large amounts of precious metals. By electrical precipitation of these particles practically all the valuable dust has been recovered. The Garfield (Utah) smelter of the American Smelting & Refining Company is about to use this electrical precipitation process in treating the fumes from its copper converters. This dust consists of much lead and some silver and other elements.

The Ohio & Colorado Smelting & Refining Company, of Salida, Col., is installing the process on its roaster stack. In this flue the velocity of the gases is 500 ft. per minute, and this improvement will make it possible to push the plant harder without loss of dust.

In the accompanying sketches is shown the arrangement of the precipitating plant and units installed at the Balaklala Consolidated Copper Company's smelter, at Coram, Col. Fig. 2 shows the general plan, and Fig. 1 is a cross-section through one of the precipitating units. In the former sketch the rows of vertical lines represent the collecting electrodes—sheets of No. 10 iron each measuring 10 ft. by 6 in. The dotted lines show the discharge electrodes formed of pairs of iron-wire strands between which is twisted the discharge material, asbestos or mica. Each precipitating unit contains twenty-four rows of twenty-four electrodes of each type. The collecting electrodes are carried by bars connected directly to the frame of the chambers, while the discharge electrodes are connected by springs to busbars supported by insulators. A cam actuates a shaker rod across the middle of the unit, agitating the electrodes to keep them free from dust. It is declared that 80 to 90 per cent of the suspended matter in the gas is precipitated by these units.

A great deal of sulphuric-acid mist is commonly lost from the parting kettles in silver refineries, but some plants now collect this mist by electrical methods. In fact, stills for concentrating sulphuric acid lose a good deal of mist which can be collected as described.

Illuminating gas often carries considerable fine carbon and tar particles in suspension. It is an important problem to remove them completely, for they clog pipes and burners. The Michigan Gas Association has carried on a series of experiments under the direction of Mr. A. H. White for the removal of tar from gas made by the distillation of soft coal, and gratifying success has been achieved by the electrical precipitation process. In San Francisco Mr. W. A. Schmidt has done as well in purifying gas made by heating crude petroleum. The tar is collected on the electrodes and run off into containers.

The tremendous volume of gas issuing from the top of a blast furnace is between 20 and 30 per cent carbon monoxide, a poisonous gas of great fuel value. A great quantity of dust is, however, also carried out with this gas and must be separated before the carbon monoxide can be used in explosion gas engines. Right here, again, is a splendid field for the application of electric precipitation of suspended dust particles as above outlined, and this work is being tried at present.

Of course, the general public is particularly interested in the problem of removing smoke particles from flue gases. In most cases it is probable that better combustion of the coal by means of uniform firing and proper draft must be relied upon, but still a measure of success is possible with the electric method. The New York Edison Company's power plant, Waterside No. 2, is giving the new process a thorough trial. Here one hundred boilers connected to four smokestacks 300 ft. high and 22 ft. in diameter will surely be sufficient for a conclusive test. The velocity of the flue gases is 38 linear ft. per second. In the evening the load is doubled. The potential of the discharge used is from 15,000 volts to 50,000 volts, and the trial is being watched with great interest.

Methods of Obtaining Greater Flexibility of Operation in Standard Transformers

By George A. Thornton and George Goldman

Within the last few years great advances have been made in improving the quality of materials that enter into the manufacture of electrical machinery. Insulating materials such as paper, cotton, linen, oils and varnishes have been bettered, allowing higher operating voltages. The iron for electrical purposes has been improved, the core loss being reduced until efficiencies as high as 99 per cent at full load have been obtained in the larger sizes of transformers. A dozen different makes of improved iron are on the market to-day. These betterments in materials, together with im-

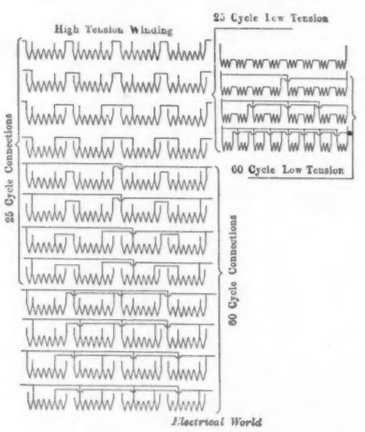


FIG. 1—TRANSFORMER CONNECTIONS FOR 25 CYCLES AND 60 CYLES

proved methods of cooling transformers, have also reduced the weight per kilowatt and the cost of production. While improvements affecting efficiencies are to be looked for in the future, they will probably be of minor interest to the users of electrical apparatus because of the larger wastes in other directions which will occupy their attention. To the manufacturer, nevertheless, they may still be of great

importance, for when all other things are about equal this factor would be the determining one in securing business.

Little attention, however, seems to have been given to making transformers which will be adaptable to circuits of different frequencies. Almost every order for sizes above 50 kw received by a manufacturer of this kind of apparatus calls for special designs and drawings, special parts and

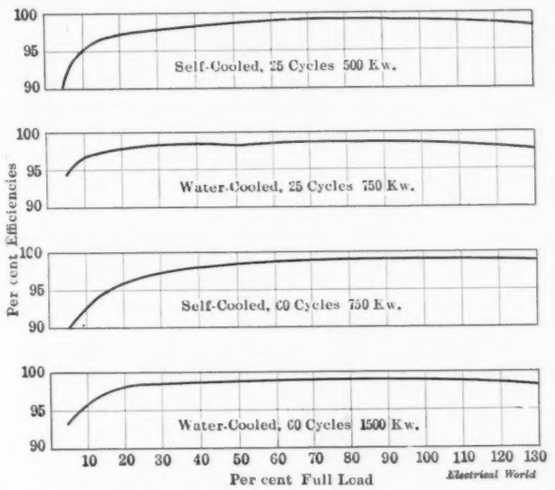

Self-Cooled, 25 Cycles 500 Kw.
Water-Cooled, 25 Cycles 750 Kw.
Self-Cooled, 60 Cycles 750 Kw.
Water-Cooled, 60 Cycles 1500 Kw.
Per cent Efficiencies
100
95
90
10 20 30 40 50 60 70 80 90 100 110 120 130
Per cent Full Load
Electrical World

FIG. 2—EFFICIENCIES OF SELF-COOLED AND WATER-COOLED TRANSFORMERS

consequent delays and increased cost. Much of this business is based, to a large extent, on quick deliveries. Manufacturers, especially the larger ones with greater momentum, must and do try to anticipate the future demand by keeping on hand a stock of apparatus which experience has shown them will most likely be required. Owing to the lack of interchangeability with circuits of different frequencies, attempts to provide for the future call for a heavy investment in stock apparatus. The equipment then, when sold, must leave the factory burdened with heavy interest, storage and obsolescence charges.

By producing more flexible transformers these charges will be greatly reduced. The obsolescence charge, aside from reducing the stock apparatus to a scrap value, has frequently been the cause of delaying or even stifling improvements. Voltage ratings generally obtainable for such

TABLE I—RESULTS OF COMMERCIAL TESTS ON TRANSFORMERS INTERCHANGEABLE ON 25-CYCLE AND 60-CYCLE CIRCUITS (13,200/4480 VOLTS)

	SELF-COOLED		WATER-COOLED	
	25-Cycle, 500-Kw.	60-Cycle, 750-Kw.	25-Cycle, 750-Kw.	60-Cycle, 150-Kw.
Core loss at normal voltage	3100 watts	6200 watts	3150 watts	6200 watts
Exciting current at normal voltage	10 per cent	4 per cent	5 per cent	2 per cent
Copper loss at full load	4690 watts	2415 watts	9670 watts	9670 watts
Impedance drop at full load	4.15 per cent	4 per cent	.....	.....
Regulation	1.1 per cent	.....	.....	.....
Gallons water per minute	.....	.....	3.5	6.5

apparatus in circuits of the same frequency are: High tension, 2200/1100; low-tension, 440/220/110. This range of voltage covers fairly well present-day lighting and motor-circuit needs, but with transformers designed for multi-frequency operation, as the following explanation and tests show might easily be done, the flexibility would be greatly increased.

Since the standard frequencies in use are 25 and 60 cycles, a number of transformers, both self-cooled and water-cooled, were changed to make them operative on either one of these frequencies. The self-cooled transformers had been built primarily for a rating of 500 kw, with a ratio of 13,200/4480 volts, at 25 cycles. The water-cooled transformers were rated at 750 kw, with a ratio of 13,200/4480 volts, at 25 cycles.

TABLE II—RESULT OF HEAT-RUN TESTS ON WATER-COOLED TRANSFORMERS INTERCHANGED ON 25-CYCLE AND 60-CYCLE CIRCUITS

Temperature	25-CYCLE, 750-KW.		60-CYCLE, 1500-KW.	
	100 per Cent Load, Deg. C.	150 per Cent Load, Deg. C.	100 per Cent Load, Deg. C.	150 per Cent Load, Deg. C.
Tank top	12.5	20	16	22
Tank bottom	6	12	6.5	11
Oil surface	15	25.5	18	27
Water, entering	13.5	15.5	12.5	12
Water, leaving	20.5	23	19	18
Primary coils*	34.5	54	40	55
Secondary coils*	34	42	35	45
Room temperature	18	16	14	13.5
Gallons water per minute	3.5	3.5	6.5	6.5
Time of heat run, hours	12	2	12	2

*Temperature determined by resistance measurements.

The changes of connection necessary when reverting from 25-cycle to 60-cycle operation are shown in Fig. 1 and are readily made on the connection boards of the transformers. It will be noticed that owing to the multiple connections of the coils the range of voltage obtainable in the secondary for 60-cycle operation is one less than that which can be had at 25 cycles. Fig. 2 shows the connection board for the secondary. The high-tension board is similar to this. For operation at 60 cycles a rating for the transformer was predetermined from a study of its design, and tests were made at this rating.

In changing from the series connection at 25 cycles to a

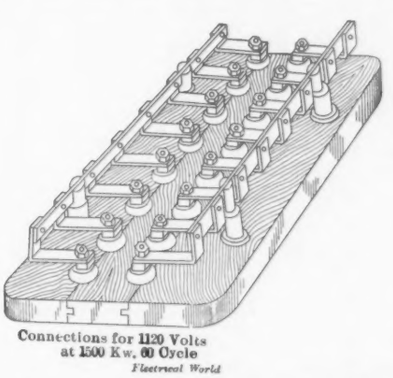


FIG. 3—TRANSFORMER SECONDARY CONNECTION WARD

multiple connection at 60 cycles, the ratio of turns in series is as 2:1.

Therefore, since (flux at 25 cycles) : $\frac{1}{25 \times 2}$ = (flux at 60 cycles) : $\frac{1}{60 \times 1} = \frac{60}{25} = \frac{5}{6}$, the flux density has been decreased in this ratio. The eddy-current loss in the core varies as the square of the frequency and the flux density; the hysteresis loss varies directly as the frequency and as the 1.6th power of the flux density. Therefore, since the

frequency is increased in the ratio of 25 : 60, while the decrease in flux is only 5 : 6, there will be a greater core loss at 60 cycles than at 25 cycles. The limitations with respect to saturation are at 60 cycles rather than at 25 cycles, in so far as heating and efficiency of the transformer are affected. However, in the new alloy steels the magnetizing current sets the limit, and as this depends primarily on saturation, the flux density at 25 cycles is still generally the governing feature. The increased core loss at 60 cycles might possibly at times conflict with the efficiency guarantees and must be guarded against. In regard to the effect of the increased heating of the iron it may be said that heated iron offers greater resistance to current flow and hence would tend to reduce the core loss. It is not thought, however, that enough heat would reach the coils from this source to harm them since the iron is in good contact with the oil.

In consideration of the difference in copper losses due to changed connections it must be noted that the resistance of the circuits, with the coils connected for 60-cycle operation, is one-fourth that for 25-cycle operation. This makes possible a twofold increase in load with no increase in I^2R loss. In the self-cooled transformers we are limited in the total losses of the iron and copper by the ability of the

TABLE III—RESULTS OF HEAT-RUN TESTS ON SELF-COOLED TRANSFORMERS INTERCHANGED ON 25-CYCLE AND 60-CYCLE CIRCUITS

Temperature	25-cycle, 500-kw.		60-cycle, 750-kw.	
	100 per Cent Load, Deg. C.	150 per Cent Load, Deg. C.	100 per Cent Load, Deg. C.	150 per Cent Load, Deg. C.
Tank top	24	32	25	25
Tank bottom	12	18	10	11
Oil surface	30	39.5	31	32
Primary coils*	41	56	40	45.5
Secondary coils*	40	56	40	45
Room temperature	18	14.6	18	16.5
Time of heat run, hours	24	2	24	2

*Temperature determined by resistance measurements.

tank to radiate the heat generated without exceeding a safe value of temperature rise. Since the core loss is increased at 60 cycles, the copper loss must be decreased; that is, the sum of the core and copper losses at both frequencies must be approximately the same. Such was the case when the 25-cycle, 500-kw transformers were rated at 750 kw at 60 cycles. One would expect the windings in the shell-type transformers to run cooler at the latter rating than at the former, and this is borne out by test. At 500 kw and 750 volts both transformers operated with about the same temperature rise. At 50 per cent overload on the 750-kw rating the transformers would be expected to be warmer than at 50 per cent overload at 500 kw, because the losses vary as the square of the current. All this is fairly well borne out by results of tests. The efficiencies of the transformer at both ratings are shown by curves in Fig. 2.

In the water-cooled transformers dependence is placed on both the tank radiation and the amount of water circulating in the cooling coils to keep down the temperature. Tests were made at a rating of 1500 kw at 60 cycles, the results showing that doubling the water circulation at 60 cycles over that at 25 cycles would give about the same temperature rises. Increasing the load and water still further would produce a steep temperature gradient and hot windings, shortening the life of the apparatus. Efficiencies at these ratings are also shown in Fig. 2.

Changing connections from 25-cycle to 60-cycle operation doubles the voltage between turns. This is the only objection to this method. As transformers are usually designed, the breakdown voltage between turns under tests is over 2000 volts. It would seem, therefore, that doubling the voltage between turns would still leave an ample factor of safety. As a matter of fact, however, transformers persist in breaking down between turns in spite of the apparently ample margin. Whether this tendency would be increased with the increased voltage between turns is problematical, although it may be presumed it would be increased somewhat. However, even in this design it is not necessary to exceed the higher value of volts per turn in the standard designs. Insulation between turns is the weakest point in transformers to-day, and improvements in this respect are now being attempted.

Adding more insulation or substituting a little more mica in place of paper would add to the insulation strength. Having thus strengthened the insulation between turns at 25 cycles, not only might the transformer then be operated at 13,200 volts on the high-tension side and at 4480 volts on the low-tension side, but also even up to twice these voltages; namely, 26,400/8960 volts. The core loss, while low at 25 cycles and 13,200 volts, would now be rather high, but a halt would be called because of high magnetizing current. At any rate, if necessary, the transformer could be operated at pressures above 13,200/4480 volts, the magnetizing current at higher loads not being so objectionable.

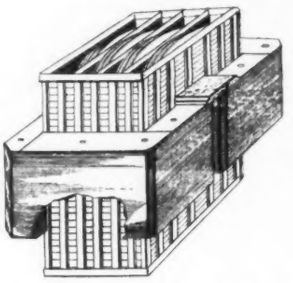


FIG. 4—ASSEMBLY OF CORE, COILS AND INSULATING CASING

The above discussion shows the increased flexibility due to multi-frequency operation. Still further advances in this direction are obtainable by converting a self-cooled into a water-cooled transformer. This was actually done, the self-cooled transformers being made to operate as water-cooled with the necessary changes in rating. Hence, one piece of apparatus may have all the following ratings:

Self-cooled, 25-cycle, 500-kw, 13,200/4480 volts.
Self-cooled, 60-cycle, 750-kw, 13,200/4480 volts.
Water-cooled, 25-cycle, 750-kw, 13,200/4480 volts.
Water-cooled, 60-cycle, 1500-kw, 13,200/4480 volts.
Water-cooled, 25-cycle, 750-kw, voltages not above 26,400/8960.
Self-cooled, 25-cycle, 500-kw, voltages not above 26,400/8960.

The feasibility of one transformer having all the above ratings was first carefully worked out from the design and then checked by actual commercial tests which bore out the calculation.

Two methods are therefore suggested for increasing the economies of transformer manufacture. First, the adaptation of apparatus to multi-frequency operation and, secondly, conversion of the self-cooled types to water-cooling, or vice versa. Fig. 4 shows the assembly of core, coils and insulating casing.

Electricity for Leper Colonies

The announcement has been made that the advisory committee of five physicians which assists the Massachusetts State Board of Charity in doing what is possible for the lepers has recommended the installation of electricity and an X-ray outfit for the leper colony. Electricity for lighting is urged for the reason that the majority of lepers have lost the sense of touch or feeling and are extremely apt to burn themselves seriously as long as lamps other than electric are used. The X-ray outfit is intended for curative experiments.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Central-Station Service in a Powder Mill

An unusual installation of equipment for electric lighting and motor service has just been completed by the engineers of the Louisville Lighting Company, of Louisville, Ky., in the new plant of the Wedgerite Chemical Company, 1 mile south of that city. When the newly organized powder manufacturers contracted for the central-station company's service it was necessary for the utility to extend its southernmost line a distance of a mile or more to the plant. Special provisions were made for strictly modern wiring and motor installation, the motors being located outside the mixing shed because of the dangerous nature of the high explosives handled.

Uniform Prices to Encourage Use of Larger Tungsten Lamps

Under a new reduced-price schedule for tungsten lamps recently put into effect by the Edison Electric Illuminating Company of Brooklyn, the company is now offering to sell to customers whose contracts call for free carbon-lamp renewals all tungsten lamps, from the 10-watt to the 60-watt sizes inclusive, at the same price. Such customers can now obtain 10-watt, 15-watt, 25-watt, 40-watt or 60-watt tungsten lamps at 30 cents each, whereas under the former schedule the 15-watt, 25-watt and 40-watt sizes sold for 33 cents apiece and the 60-watt size for 45 cents. By making the same price for the small 10-watt lamps as for the 60-watt size the company has been able to encourage the use of the larger units, for, according to the laws of human nature, a customer will select the largest lamp he can buy for the price.

Partial and Summer Service to Isolated Plants

Established isolated plants offer a considerable field for central-station service in summer, even where heating requirements in winter make isolated-plant operation preferable. Running non-condensing in the summer, the cost of fuel, firemen's wages, oil expense and various minor items can be saved by purchasing energy. The cost of fuel, firemen, waste, oil, packing, etc., would amount to at least 0.75 cent per kilowatt-hour, and in most cases from 1 cent to 2 cents per kilowatt-hour. It would not be policy to lay off a good operating engineer, and his time could be very profitably spent in overhauling the equipment, making necessary alterations, and, in general, preparing the plant to handle its winter load most economically.

The central station equipped for the December peak has ample idle capacity in summer, and such a taste of central-station service might make a customer for all or a large part of his year-round load.

Another possibility is that of supplementing the isolated plant with power for part of its load, especially where the factory has been enlarged or the power plant is outgrown. Already this is being done to some extent, but there is room for a great deal more work along these lines. Here the salesmen can figure depreciation, investment and expense, as well as labor and fuel, against the steam cost, and can often get a year-round load at a rate which will well compensate for being carried through the winter peak.

An Electric Sign per 250 Inhabitants

At Lexington, Ky., 134 electric signs have been installed by local merchants, business houses, theaters, etc., making a total of nearly 10,000 sign lamps supplied from the circuits of the Lexington Utilities Company, which furnishes the local central-station service. As Lexington has

FIG. 1—NEW ELECTRIC SIGN, LOUISVILLE

a population of about 34,000, the little Blue Grass city can show an average of about one sign per 250 inhabitants, according to the records of the Federal Sign System, which has a local office.

The Lexington Utilities Company recently erected a strik-

FIG. 2—DISPLAY ROOMS

ing electric sign, measuring 8 ft. by 14 ft., on the façade of its own eight-story building at the corner of Main Street and Cheapside. Two flaming torches on this sign burn continuously. The word "Light" is first flashed on in 16-in. letters and is then extinguished as the representation of an electric iron appears. Green lamps outline the cord, and

the socket is shown in white and amber globes. As the iron disappears, the word "Power" comes on, and then the entire sign flashes into view, the picture being held for one minute.

Electric Appliances as Standard Household Furnishings

In the belief that electrical appliances for household service have reached the point where they may be classed as standard furnishings, a leading Boston store has inaugurated the direct sale of such apparatus and has equipped its model six-room "apartment" with a complete line of electrical devices illustrating the latest possibilities in heating, lighting and motor service. The apartment contains a reception hall, library, bedchamber, bathroom, kitchen and laundry, the total floor area covered being about 2000 sq. ft., and it is equipped with a varied assortment of the latest appliances, mainly of Simplex, General Electric and Landers, Frary & Clark manufacture. Three demonstrators are connected with the department, which is in charge of Mr. E. W. Bates, formerly manager of the Cohasset Electric Company and well known in the New England central-station field. The six rooms were re-wired in conduit prior to the opening of the electrical display, and, in accordance with recent requirements, a red pilot lamp is included in the circuit of every heating appliance.

Central-Station High-Pressure Fire Service for Boston

The city of Boston is preparing to install a high-pressure water supply system for fire protection throughout the district north of Berkeley and Dover Streets. An underground station for the motor-driven high-pressure pumps will be constructed on Charles Street, between Beacon and Boylston Streets, care being taken to conceal the plant so as not to mar the appearance of the Public Garden and Common.

Six multi-stage 3000-gal. centrifugal pumps, delivering their output at 300 lb. pressure per sq. in., will comprise the initial equipment. Each pump will be direct-connected to two 800-hp induction motors—one for 6600-volt, 60-cycle operation and the other utilizing 13,000-volt, 25-cycle energy. In this way provision is made for emergency operation from the local elevated-railway 25-cycle system in the remote possibility of interruption to the 60-cycle service of the Boston Edison Company. The design of the station includes space for two additional pumping equipments, and, in addition, service will be required for heating and lighting purposes, as well as for the operation of a small amount of auxiliary apparatus.

The contract with the Edison company calls for a maximum supply of 4800 hp, or 3580 kw, of 6600-volt, 60-cycle energy. The city's engineers in charge of the high-pressure undertaking at the outset recommended central-station service as affording the maximum conditions of reliability, convenience and economy in the operation of the system. The contract with the Boston Elevated Railway Company for auxiliary service is made by the central-station company itself and will be taken advantage of only in case of interruption to its own system.

Fire-pump connections will be tapped from the central-station system at three points, the Head Place, Jordan-Marsh and Houghton & Dutton stations, each line being of 2500-kw capacity. Different groups of transmission lines supply these stations over divergent routes, thus providing every possible insurance against accident, in addition to the storage-battery equipment in the city substations. The city water-works mains will be used as the source of supply, although in case of emergency salt-water connections will be available with the bay.

Central-Station Service in a Great Newspaper Plant

The New York *Times* recently moved its mechanical plant from its famous Broadway tower building to its new eleven-story annex on Forty-fourth Street, where are installed four double sextuple Hoe presses and one octuple press, whose combined double-page web output is produced at the rate of 12.5 miles a minute, or 750 miles an hour.

New York Edison service is used throughout the new plant. As declared editorially by the paper itself: "The adoption of central-station service saved considerable money in first cost of installation. It saved valuable space. It avoided fires in the boilers in the warm months of the year, thereby keeping down the temperature of the press room. It minimized the handling of coal and ashes to the winter season and to the smaller quantities incidental only to heating the structure. It saved the extra cost of a 'breakdown' connnection for emergencies."

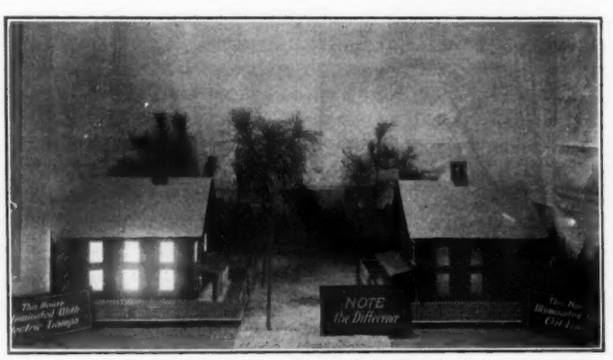
The Times Annex has 17 miles of electric conduits with 49 miles of wire, excluding telegraph and telephone service. The service connections have a carrying capacity of 2200 amp for lighting and 2000 amp for motors. There are supply lines taken from both Forty-third and Forty-fourth Streets, each of full combined rating, while a 2700-amp circuit is led from the Times Building.

Each double sextuple press is driven by two 60-hp main motors and two 5-hp auxiliaries. A complete system of push-button control is provided, with twenty-six stations, from any of which the presses can be stopped, locked or started.

Not only the press room but every department of the entire business has been planned for measuring the supply used for different purposes. Practically every function of the newspaper and its building has been metered so that the work of each press, each elevator, each pump and each autoplate may be closely watched. Each line set by each linotype is charted by electricity. Every movement of every press is charted. Every automatic start and stop of a pump is recorded. The supply of light to each department is measured. Recording thermometers and a hygrometer will record temperature and humidity at all hours of the day and night.

Which House Is Yours?

During its recent house-wiring campaign the Meridian (Miss.) Light & Railway Company displayed an attractive window exhibit showing two miniature dwellings, one duly lighted by an old-fashioned illuminant and the other rendered brilliant with modern tungsten lamps. Placards in the window called attention to the difference, and the display attracted a measure of local attention that was quite out of proportion to its small cost.



WINDOW DISPLAY, MERIDIAN, MISS.

The houses were made from ordinary lamp boxes, with the aid of a jar of paste and a pair of scissors. The windows were covered with tracing paper, giving the appear-

ance of frosted panes. The entire show window was lined with a sky-blue cloth, the ground being represented by green paper, and the background was an ordinary wall-paper border, with a forest design. The fences were made from small strips of wood, and the road was formed of ordinary sand. The trees seen in the picture were the tops cut from small pines.

Waste in Compiling Unnecessary Reports

By D. C. Bonn.

In going through the work of various departments of large central-station electric companies it is often evident that of the great number of monthly reports regularly submitted for the information of officials and department heads some may be of little real usefulness. Recognizing this tendency, one executive of a large company asked to have sent him a complete set of the forms used regularly by certain offices and to have stated thereon full particulars concerning their use. In consequence of this special investigation many reports were discontinued, while others were condensed or changed so as to be of more real value. The time consumed in going over this mass of data was well spent.

How many reports have been started and are continued at the request of the department head?

How many of such reports have long since served their purpose?

Of what real value are those he initials and files each month?

Could he not instead have test reports made for his information when needed?

Does he know the number and character of the reports being made and sent him each month?

Has he thought of any changes to make them less burdensome?

After all, is the information worth what it costs to compile it?

The truth of this growing burden and expense is that reports are inaugurated from time to time by the men at the head of departments, while preceding statements are seldom discontinued.

More attention should also be given to the drawing up of forms and reports. For example, in the plant mentioned, for many years separate forms were used for material recovered and that returned to the storeroom. After a little consideration, however, a form was adopted to serve both purposes.

A vast amount of report work is often executed at the beginning of each month which hinders every department of the organization in keeping up its routine work at the end of the thirty-day period. Every head of a department and company chief clerk should realize the tax, effort, time and expense involved in the compilation of this great amount of data, which is so often allowed to pass through various departments from month to month and year to year without its being given earnest and proper consideration.

The Value of the Lighting Engineer to the Central Station

By F. H. M. Riley

The true illuminating engineer should be not only familiar with physical laws pertaining to the use of light but also alive to the importance of the hygienic and esthetic phases of his subject. To the central station the lighting engineer can be valuable in two ways—first, in securing new business, and, second, in rendering satisfaction to the company's present lighting customers, for a satisfied customer is now recognized to be among the most valuable assets that a corporation, public utility or small business can possess.

One of the greatest central-station problems is that of closing down isolated plants in large stores, factories, hotels, etc., for it is from these places that bulk business is often to be obtained. Here the lighting specialist can be especially useful, showing the private-plant owner how his connected load could be lessened or rearranged, thus contributing to the economy of central-station service. While

FIG. 1—WINDOW ILLUMINATION WITH ORIGINAL INSTALLATION

there are many other reasons which may be advanced to secure the business, such as reduced insurance rates, elimination of dangerous boilers, smoke and dirt, cost of upkeep, depreciation, etc., the point of lessening the connected load is pertinent.

An example will show the effectiveness of the lighting specialist in this respect. The Kansas City Electric Light Company recently undertook to re-design the lighting system of a large local store, the George B. Peck Dry Goods Company, which operated an isolated plant, the object being to cut the existing energy consumption in half without reducing the effective illumination, in this way rendering easier the task of securing the business for the central station. The problem was rather difficult, since the new lighting units had to be placed on outlets already installed, for the wiring was antiquated, and, while it would stand if no extensions were made, any changes would have necessitated the complete rewiring of the building. Such a course would have entailed an expenditure of about $10,000, which was out of the question.

Approximately fifty-five 650-watt arc lamps were in operation throughout the store. Although there were a number of tungsten and tantalum lamps in use, the majority of incandescent lamps were 50-watt and 60-watt carbon-fila-

FIG. 2—SAME WINDOW AFTER REDESIGN WITH DARK AREAS IN FOREGROUND REMOVED

ment units. In making the conversion to high-efficiency illuminants arc lamps were replaced by 250-watt bowl-frosted tungsten lamps equipped with translucent glass shades. Tungsten lamps of proper wattage were employed to supersede the carbon and tantalum units. All lamps used were bowl-frosted and properly shaded—an important precaution that had not been hitherto observed, the result being in-

creased efficiency and freedom from glare. Clear lamps were used, of course, in the showcases and windows.

Particular attention was paid to the lighting of the rug racks. Although the consumption here was not diminished, the intensity and distribution were vastly increased and improved. Scoop-shape, silver-plated glass reflecters, con-

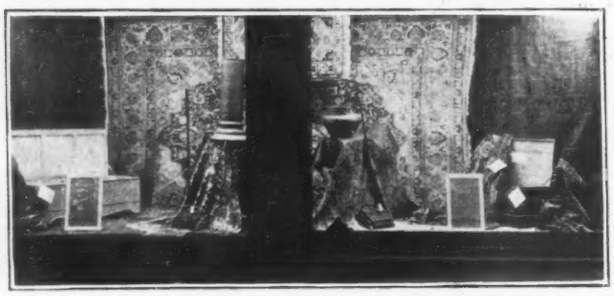


FIG. 3—EXHIBITING HOUSE FURNISHING UNDER IMPROVED ILLUMINATION

taining 25-watt clear-globe tungsten lamps, were placed at intervals of 2 ft., being mounted about 12 in. below the top of the rugs displayed. While this method does not give an even distribution over the entire surface of the rug, it serves to distribute the light on that portion which is studied by the purchaser. The ordinary method of rug-rack lighting is much less effective, since it tends to place the highest intensity at the top of the rugs, despite the fact that the purchaser studies the lower portion.

The improvement in window illumination is revealed by the accompanying illustrations. Fig. 1 shows one of the Peck windows before the lighting was changed, and Figs. 2 and 3 windows after the installation was completed. The decrease in wattage in the windows was practically one-half, after the carbon and tantalum lamps had been replaced by tungsten units with reflectors. The photographs were made with identical exposures, although the new installation had been in operation about five months before the latter pictures were taken.

The alteration-room lighting is shown in Fig. 4. Tin troughs containing carbon lamps, placed 20 in. above the tables, formerly supplied the illumination of these rooms. The result was inefficiency and headaches among the women employed in this department. The new system is general in type, employing 250-watt bowl-frosted tungsten lamps fitted with glass shades and resulting in an even, diffused light, free from shadows. The health and the condition of the eyes of the women employed here have since improved, with a corresponding increase in efficiency.

FIG. 4—ILLUMINATION OF ALTERATION ROOM

The great saving in wattage thus effected in the lighting of the building enabled the owners of the store to change four hydraulic elevators to electric cars, each driven by a 30-hp, direct-current, 110-volt motor, and also to install a 25-hp motor to operate the pumps on the automatic sprinkler system. Prior to these changes the maximum demand, for lighting alone, was 123 kw; after the new lighting system was installed and the elevators and pump motors had been added the total maximum demand dropped to 105 kw. The elevators, meanwhile, have increased their average daily travel by 150 trips since the change, and the general illumination has been improved 10 to 15 per cent. Aside from the foregoing the entire building is being heated by steam taken from the mains of the lighting company. Space occupied by the plant is now utilized for the sale of merchandise.

The cost of the entire change approximated $12,000. To operate the former private plant the cost was approximately $16,000 per year, and since the bill for the central-station's service, including the steam for heating, will not exceed $10,000 per year, the saving effected will pay for the changes in less than two years.

The lighting specialist can be of assistance also in giving satisfaction to the lighting customers of the company, advising them of best methods of illumination and designing installations of commercial or residence lighting, where the object is to reduce energy consumption or to increase the advertising value of a commercial interior by efficient and different lighting. On the satisfaction of the customer depend the growth and development of every business.

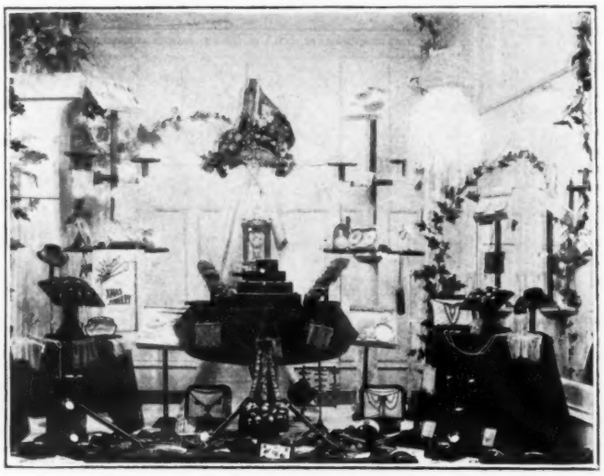


FIG. 5—ILLUMINATION OF DISPLAY OF JEWELRY AND SILVERWARE

People are likely to become vexed at a public utility upon the least provocation. Lighting companies operated by large corporations easily incur the ill will of the public. The elimination of such prejudice should be the aim of every utility, and in this direction the work of the lighting specialist can be particularly efficient.

Again, the lighting specialist can be effective in combating unscrupulous manufacturers and jobbers of glassware and accessories in the disposal of their inefficient lighting appliances, practices which have caused the management of central stations no little worry and trouble. These manufacturers and merchants have maintained a policy of selling direct to the consumer or fixture dealer, who in many cases knows very little of correct illumination. Later, it is difficult to convince the customer that his poor or incorrect illumination is not the fault of the lighting company but is due to the fixture installation. This alone is one of the strongest reasons for the employment of a lighting specialist by the central station.

There are other ways in which this newest of professions may be of use to the public utility, but the preceding paragraphs contain the most important. The lighting specialist, although new in the engineering field, is rapidly coming into his own, and making the world a better place to live in, by spreading the gospel of the correct, hygienic, artistic and efficient use of artificial light.

Electrically Operated Excavators on Calumet-Sag Channel of Chicago Drainage Canal

Practically all construction operations on the Palos Park section of the Calumet-Sag Channel of the Chicago Drainage Canal are being accomplished by the use of electricity. This new channel is being excavated to connect the Calumet River with the main channel of the Drainage Canal, thus draining off sewage from the lower end of Lake Michigan. The Green & Sons Company is the contractor for Section No. 5 of the new channel, which is near Palos Park, a suburban town a few miles west of the southern end of Chicago. This section is about 8000 ft. long, and the channel is 150 ft. wide across the top and 50 ft. wide at the bottom, the excavation being about 37 ft. deep. Nearly 1,000,000 cu. yd. of earth is to be removed from this section.

Two electrically operated Lidgerwood-Crawford drag-line excavators are used on the work. Fig. 1 shows one of them. The buckets used are each capable of lifting 2.5 cu. yd. The excavator is carried on a turntable mounted on trucks which run on two sets of parallel tracks. These tracks are placed on both sides of the channel, so that both of them can be worked at the same time from opposite sides. The tracks are built on platforms and laid in sections, which are bolted together.

The method of propelling the machines is rather novel. When it is desired to move the excavator along the track, the boom is pointed in the direction of travel and the

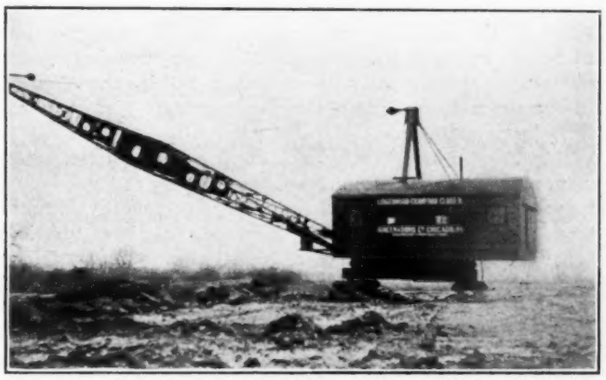


FIG. 1—ELECTRICALLY OPERATED DRAG-LINE EXCAVATOR

scoop let down until it bites into the earth. The drag-line is then drawn in, pulling the entire mechanism in the direction desired.

All of the maneuvers of the scoop are accomplished through the boom hoist-line and drag-line. The hoist and drag lines are wound on drums, which are rotated through gearing and friction clutches by two wound-rotor induction motors, which operate continuously. These motors are both 112-hp machines, and run at 720 r.p.m. at no load and 690 r.p.m. at full load.

Compressed air is used to operate the friction clutches and band brakes on the drums. It is provided by a pump driven by a 5-hp induction motor of the squirrel-cage type. A 52-hp wound-rotor induction motor operates the turntable. All of these motors are controlled from a single switchboard and are of the 440-volt, three-phase, 60-cycle type built by the General Electric Company.

Electricity is supplied by the Public Service Company of Northern Illinois. A three-phase, 33,000-volt transmission line, consisting of three No. 0 copper conductors supported on single cross-arms, connects the Hodgkins substation with the Blue Island generating stations. Cedar poles 35 ft. long are used and spaced 120 ft. apart, with a 0.375-in. stranded, galvanized-iron ground wire running along the top of the poles about 4 ft. above the center line of the cross-arms.

A branch line taps the 33,000-volt line about half way between the Hodgkins substation and the Blue Island station. Disconnecting switches and 10-amp S. & C. fuses are used. The branch line runs to a temporary substation located on McLaughrey Road in the vicinity of Palos Park. The building is a frame structure covered with corrugated sheet iron. The branch line consists of three No. 6 copper-clad conductors carried on 30-ft. cedar poles and spaced 140 ft.

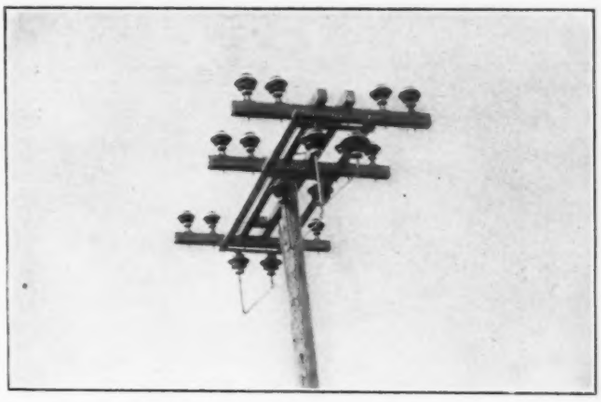


FIG. 2—HIGH-POTENTIAL FUSES AND DISCONNECTING SWITCHES

apart. Possible interruption of service is lessened by the fact that the branch line is fed from two directions.

Located in the McLaughrey Road substation are three delta-connected 100-kw, 33,000-2300-volt step-down Westinghouse transformers. The 2300-volt line is carried from the substation along both sides of the proposed drainage canal on 30-ft. poles spaced 140 ft. apart and just outside the right-of-way so as to clear the spoil banks.

In order to avoid tapping the 2300-volt lines which run along the sides of the channel in a different place every time the excavator is moved, a transformer truck, shown in Fig. 3, is used. This truck carries three 50-kw, 2200-440-volt transformers. The high-tension taps from these transformers are secured to a cross-arm on a 20-ft. mast carried on the truck. From this cross-arm short lines connect with the distribution line running parallel to the channel. A steel-armored cable, containing three No. 0 stranded conductors, connects the 440-volt taps of the transformers with slip-rings on the lower side of the turntable. These slip-rings are connected, through conduit, with the switchboard on the excavator. The cable permits the machine to be moved about 800 ft. without moving the transformers.

During the cold weather which has prevailed in Chicago

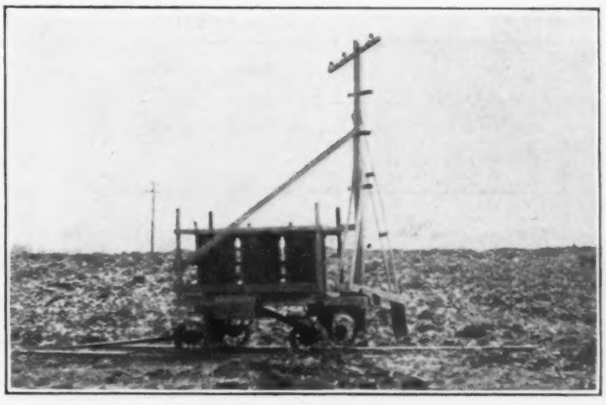


FIG. 3—TRANSFORMER TRUCK

this winter the contractors on this section of the canal have had none of the troubles that usually attend the use of a steam-operated excavator at this season of the year. Work has been carried on during twenty hours out of the twenty-four, and, with both excavators working, about 4200 cu. yd. of earth have been removed each day.

Illumination and Wiring

Influence of Colored Surroundings on the Color of the Useful Light

Much attention has heretofore been given to the color value of illuminants, although, after all, the color value of the useful light is perhaps of greater interest to the user.

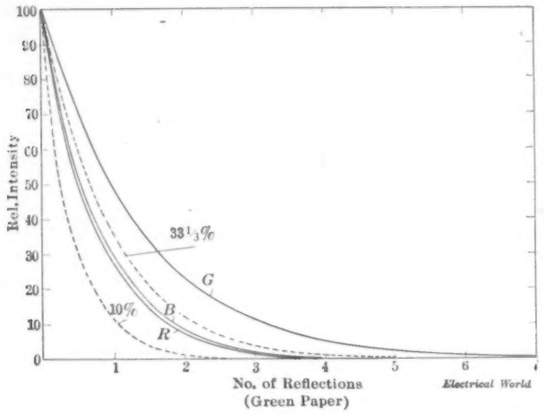


FIG. 1—PERCENTAGE OF ORIGINAL LIGHT REMAINING AFTER VARIOUS REFLECTIONS

It has been suspected that, especially in indirect lighting, the colored walls and ceiling, even though nearly white, would effect appreciable color changes in the incident light. In the course of the investigation reported by Mr. M. Luckiesh, physicist for the National Quality Division of the General Electric Company, Cleveland, Ohio, for the meeting of the Chicago Section, Illuminating Engineering Society, at Milwaukee, Wis., Feb. 22, theoretical calculations and colorimeter measurements were made to determine the magnitude of the influence of colored surroundings on the color of the useful light. For example, it was shown that only a moderate yellow paper is required to change the color of tungsten light to that of a carbon-filament lamp.

Based on theoretical calculations involving the summation of various series representing the total reflected and re-reflected light falling on the walls of a diffusing sphere,

TABLE I—COLORIMETER MEASUREMENTS IN A MINIATURE ROOM UNDER VARIOUS CONDITIONS

No.	Condition	R	G	B
1	Tungsten lamp	33.3	33.3	33.3
2	Carbon lamp, 3.1 watts per candle	38.7	34.7	26.6
3	Carbon lamp, 4 watts per candle	43.0	33.7	23.3
4	Yellow walls and ceiling, indirect	53.1	37.0	9.9
5	Yellow walls and ceiling, direct	47.6	35.7	16.7
6	Yellow walls and white ceiling, indirect	43.2	35.5	21.3
7	Yellow walls and white ceiling, direct	42.1	35.3	27.6
8	Yellow paper	43.6	38.4	18.0
9	Green paper	34.5	39.8	25.7
10	Green ceiling and green walls, indirect	35.9	43.6	17.5
11	Green ceiling and green walls, direct	36.3	37.8	25.9
12	Green walls and yellow ceiling, indirect	48.2	42.6	9.2
13	Green walls and yellow ceiling, direct	39.8	39.6	20.6
14	Green walls and white ceiling, indirect	36.6	34.1	29.3
15	Green walls and white ceiling, direct	35.2	34.6	30.2

the author obtained figures showing the actual luminosity values of the red, green and blue components of the light after undergoing several reflections. These results are represented in Fig. 1 accompanying, where the dotted lines show the rapid decrease in the light values for a paper of 10 per cent reflective coefficient, compared with one of 33.3 per cent coefficient. In Fig. 2 are plotted the relative amounts of the red, green and blue components in the light after it has suffered various reflections. The sum of the ordinates at any particular reflection equals 100 per cent. Here the rapid approach toward a pure green is shown after the light has undergone several reflections.

Experiments in Miniature Room

After purely theoretical computations it becomes of interest to make observations with an Ives colorimeter and in a room papered with various colored wall-papers. With

TABLE II—RELATIVE BRIGHTNESS OF VARIOUS PAPERS ILLUMINATED FROM DIFFERENT SOURCES

Illuminant	Color of Paper				
	White	Red	Yellow	Green	Blue
Tungsten (Ruby) lamp, per cent	100	84	96	23	9
Mercury - vapor lamp, per cent	100	8	95	33	14
Tungsten lamp, per cent	100	36	91	26	11
Carbon, 4 watts per candle lamp, per cent	100	41	94	27	11

actual wall-papers there is more or less specular reflection. The light specularly reflected does not necessarily undergo the same change in its color as in the case of diffuse reflection. If the paper is placed at such an angle as regularly to reflect the light from the illuminant into the colorimeter, obviously the true color of the paper will not be obtained, the readings instead more nearly representing the color of the illuminant.

It is impracticable to use an actual room in these experiments owing to the great amount of light required for the colorimeter readings and also the large surfaces which must be re-papered. A cubical box, 4 ft. on a side, was therefore arranged with a single fixture in the center of the ceiling, the light source being a 500-watt tungsten lamp used both directly and indirectly. With the direct system no reflector was used, of course permitting considerably more than the usual percentage of light flux to reach the walls and ceiling. Green, yellow and white papers were used. The green and yellow papers were selected from regular wall-paper

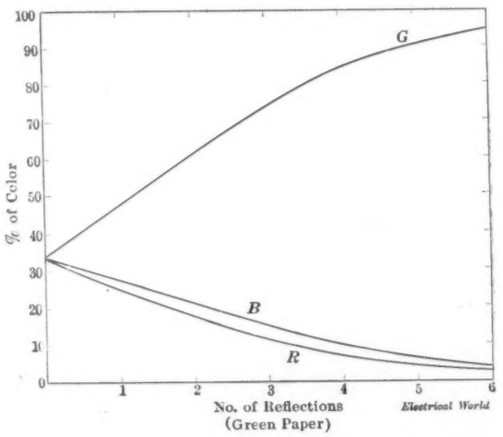


FIG. 2—PERCENTAGE OF THREE COMPONENTS AFTER REFLECTION FROM GREEN PAPER

stock and were quite unsaturated colors. The white used was blotting paper. All colorimeter readings were made with the photometric field of constant brightness. From Table I, it will be noted that the readings for the tungsten lamp are shown as being equal for the red, green and blue. This of course is legitimate, for the readings are merely

relative. It is also more convenient. The readings are not reduced to sensation values for the same reason, and further because only the magnitude of the change in color due to reflection from colored surroundings is desired. The results are also plotted in trilinear co-ordinates in Fig. 3 It is interesting to note that 4, 5, 6, 7 show a gradual change from yellow toward white, as would be expected. These results are consistent with the theoretical computations. The color values of the carbon lamps are given relatively to the tungsten lamp, in order to illustrate the change in color of the tungsten light due to colored surroundings. The color values of the yellow and green papers show the color of the tungsten light after being once reflected.

Instrument for Observing Color Changes

An instrument for observing the change in color of light due to colored surroundings is easily made. A box 16 in. long and 4 in. square, coated white inside, contains a lamp of the same type and voltage as used in the room in question. This lamp illuminates a piece of opal glass. Variation in the brightness of the glass is obtained by means of a diaphragm. In an adjacent compartment is a mirror inclined at 45 deg. to the vertical. Above this is a ground opal glass which receives the light just as it is received on the working plane. By means of the mirror this glass is seen adjacent to the glass illuminated by the electric lamp. When a brightness match is made the change in the color of the illuminant is observable. Such a box was used in the present experiments, changes in the color of the illuminant due to colored surroundings being noted even in extreme cases of direct lighting.

The coefficient of reflection of a surface is not the same for all illuminants unless that surface is white. With the ever-increasing diversity of light sources and refinement of illuminating engineering procedure it may soon become desirable when giving reflection coefficients to include also in the statement the light source for which the coefficient was determined. To illustrate this point some relative reflection coefficients of various colored papers of high saturation are given in Table II. These were determined only relatively, by measuring the relative brightnesses in a fixed direction while the specimen was illuminated successively by various illuminants at hand. The brightness measurements were made by means of a flicker photometer, the comparison standard being a white matte surface (magnesia) illuminated by a tungsten lamp. The papers were all viewed at the same angle and likewise illuminated from the same direction. Specular reflection was carefully avoided. The results for the carbon and tungsten lamps are the averages of a great many determinations.

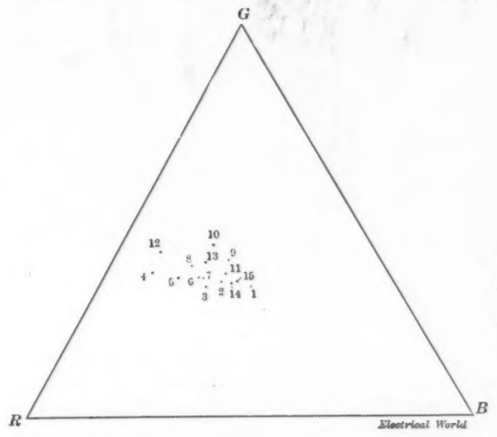


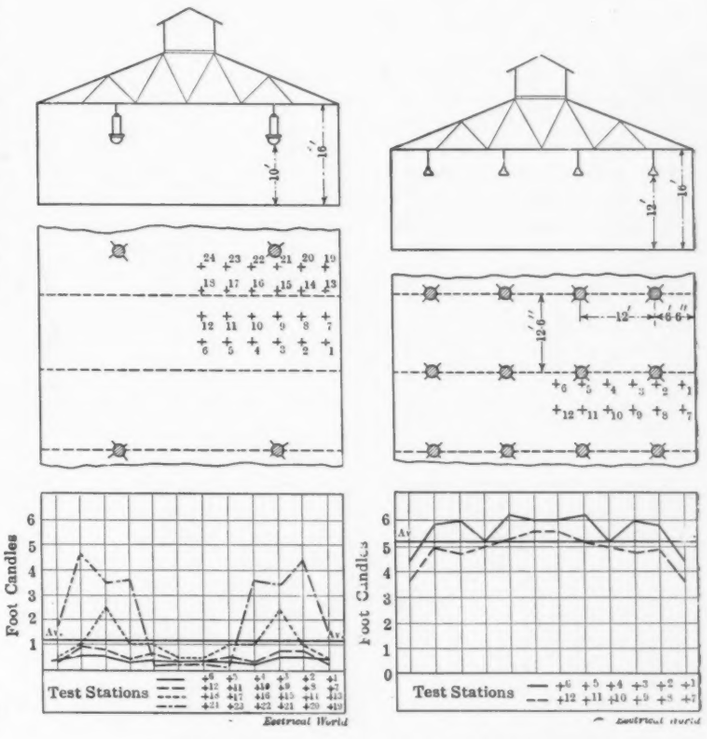
FIG. 3—RESULTS OBTAINED IN A SMALL ROOM

Comparison of Arc and Incandescent Lighting in a Shop Building

The accompanying illustrations and curves show the arrangement and distribution secured by lighting a shop building with inclosed arc lamps and with tungsten units, the wattage totaling the same in each case. Mr. Ward Harrison, of the National Quality Lamp Division, General Electric Company, Cleveland, Ohio, submitted these figures in a paper on the lighting of mill structures before the Association of Iron and Steel Electrical Engineers at its Milwaukee meeting. In addition to the arc lamps, the original installation was supplemented by about fifty carbon drop-lamps over the individual machines. These were found unnecessary when the Mazda units were employed. It should also be noted, as pointed out by Mr. Harrison, that in addition to producing a much higher average intensity of light, the distribution from the tungsten units is far more uniform. The intensity from the arc installation, on the other hand, varied between 0.17 and 4.45 foot-candles at points which required equally good lighting. In the accompanying table of data the carbon drop lamps are omitted.

DATA ON LIGHTING OF A SHOP BUILDING.

	220-Volt Arc Lamps.	110-Volt Tungsten Lamps.
Total number of lamps required	16	80
Height of lamps above floor, ft.	10	12.5
Height of test plane, ft.	3.5	3.5
Lamps per bay	1.25	4
Watts per lamp	750	150
Rated specific consumption, watts per candle	.....	1.12
Area of bay (12.5 ft. by 49.5 ft.), sq. ft.	618	618
Watts per sq. ft.	0.97	0.97
Average intensity, ft.-candles	1.15	5.25
Effective lumens, per watt	1.18	5.40
Annual operating cost per lamp (4000 hours)	$53.30	$13.85
Annual operating cost of installation	852.80	1108.00
Annual cost for equal illumination	3890.00	1108.00



COMPARISON OF ARC AND TUNGSTEN LIGHTING

Effect of Sleet Storm on Distributing Lines at Rochester, N. Y.

The accompanying illustrations show in rather marked degree the effect of a sleet storm which swept over Rochester, N. Y., early last month. There was nothing unusual about the storm so far as record-breaking performances are concerned; but a combination of snow and wind was sufficient to play such havoc with the overhead lines of the

FIG. 1—BROKEN POLE AT ROAD CROSSING

lighting, telegraph and telephone companies as has not been known in a long time in the Flower City. Rain, which had been falling in the afternoon of Jan. 3, changed to heavy, wet snow, which clung to the wires and poles and quickly froze with falling temperature into a solid mass. As the evening approached, the wind began to increase in velocity, reaching at length a maximum of 36 miles an hour. Added to this, limbs of trees weighted down with an accumulation of snow and ice began to snap off and fall across the already heavily loaded wires, and here and there entire trees were blown against the poles and lines. Fig. 1 shows how the branches of trees on Murray Street bore down on the pole in front of them. The wires on the lower arms were caught, demonstrating the desirability of getting poles and wires off streets where shade trees are encountered. Many poles throughout the city were found in like condition.

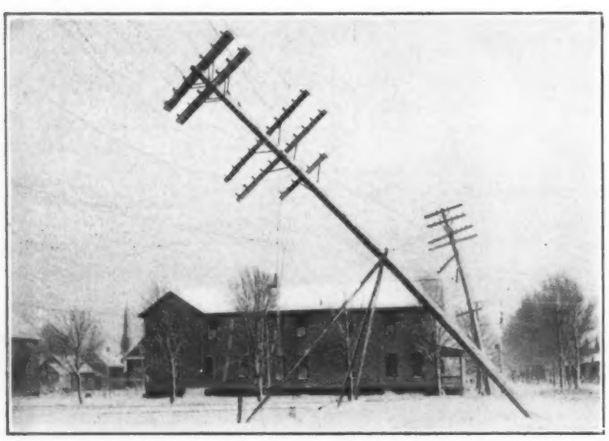
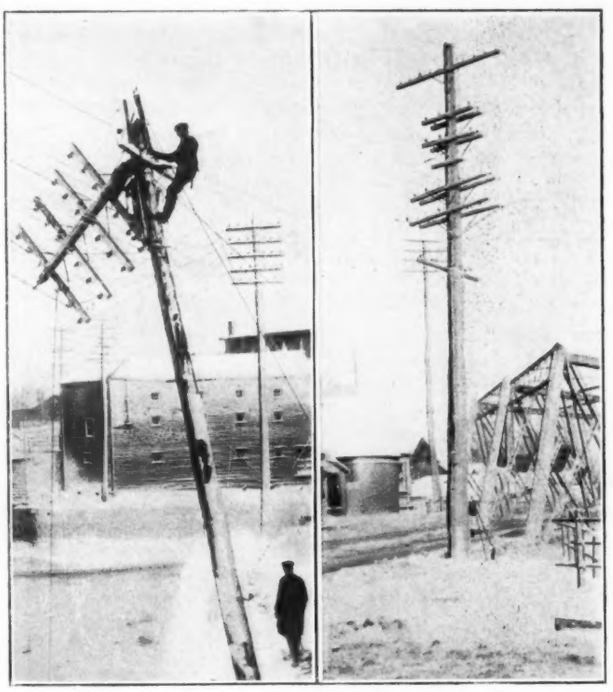


FIG. 2—WIRES HANGING ACROSS RAILROAD TRACKS, CAUSING DELAY TO TRAINS

The Niagara, Lockport & Ontario Power Company shut down its transmission lines very early during the storm so that every available machine in the stations of the Rochester Railway & Light Company had to be started in order not only to maintain good local service but also to afford some relief to the Syracuse and the Buffalo, Lockport & Rochester railways, which were suffering from the Niagara shut-down. No attempt was made during the night of the storm to make repairs, the linemen devoting their efforts to clearing the lines and eliminating dangers. Whenever indications in the stations showed a circuit grounded or crossed that circuit was shut down entirely. In the early part of the evening a telephone wire dropped across an arc circuit with fatal results to a pedestrian, and the Mayor of the city gave permission to shut down every arc circuit having aerial lines.

Fig. 2 shows a pole which fell over the tracks of the Buffalo, Rochester & Pittsburgh crossing at Hague Street, delaying traffic about one hour until propped up as shown. The two double cross-arms on top of the pole carry lines of the Rochester Railway & Light Company, and it will be noted that every wire is intact. One of five poles near the canal on South Avenue which collapsed during the storm is shown in Fig. 3. This pole was double-guyed, and the point of breakage occurred between the points of guy attachment, giving mute evidence of the tremendous crushing strain imposed by the ice and snow load. This canal pole line carries two three-phase circuits and twelve arc



FIGS. 3 AND 4—POLES BROKEN AND STRIPPED OF WIRES NEAR CANAL BRIDGE

circuits. A force of linemen had five new 60-ft. poles in place and all circuits cleared the day after the storm. Fig. 4 shows a pole stripped of every wire except the guy wires.

It is estimated that 40 per cent of the damage to the lighting company's circuits was due to wires of other companies falling across and short-circuiting the high-tension lines; 40 per cent was due to falling trees or branches bearing down on poles and wires, and 20 per cent was due to direct failure of poles and wires under stresses imposed by wind and snow. The N. E. L. A. specifications call for construction to withstand an ice load on the conductors of 0.5 in. with wind pressure of 8 lb. per sq. ft. on the projected area of the wires so loaded. Wires were found coated with 1.5 in. of ice, and during short periods the wind pressure imposed a strain much greater than that specified.

As a result of the storm the company proposes to push its rear-lot-line method of distribution with high-potential wires, transformers, etc., underground and the low-potential and service wires on short poles on private property as free from trees as possible and with the telephone wires strung below the light wires.

Letter to the Editors

Electric Fuse Testing

To the Editors of the Electrical World:

SIRS:—The article on "Electric Fuse Testing" by Dr. A. A. Somerville in your issue dated Jan. 18, 1913, conveys a very incorrect impression to those of your readers who have had no opportunity of investigating this subject carefully and, further, contains several contradictions and erroneous conclusions.

The author claims that his investigations have disclosed several new features. After reading the paper most carefully, it does not appear that there is a single statement contained therein that has not already been touched upon by earlier investigators, and these features are in no sense new. His claim of having made an "exhaustive series of tests" is hardly borne out by the brief description given or by the conclusions he draws from his very limited number of observations. The art of fuse construction is by no means so simple. Various investigators have spent practically their entire time for many years in covering this field. Is it possible, then, for an observer to reach definite conclusions from any such set of experiments as is referred to? Many of the conclusions are so contrary to accepted laws that they disclose at once the superficial nature of the investigations.

The author states that "the capacity of fuses increases with time because repeated annealing renders the fuse metal a better conductor." This statement is not borne out by the facts, and if there is any variation whatsoever in the fuse capacity, it is a slight lowering of the current-carrying power due to the tendency to crystallization of the fuse metal under repeated heating and cooling, which renders it more readily separable. This tendency, however, is so slight that except in cases where the link is absolutely broken by the expansion of the tube it is almost indeterminable. The possibility of annealing lead tin alloys, or alloys in that classification, is certainly a most remarkable suggestion.

The author's description of the cartridge fuse would indicate a most profound lack of familiarity with that device, since the description is quite different from the almost universal standard of inclosed fuses. The article says: "This tube is fitted with metal caps to slip into terminal receptacles of the holder. The fuse wire is soldered or riveted to these metal caps." This is quite incorrect, as it is the prevailing practice of standard approved fuse manufacturers to attach the fuse wire to copper terminals which are then soldered to the cap, and in no single instance have I ever seen one in which the fuse wire was riveted to the cap.

His next conclusion that "almost any kind of wire can be used as a fuse" (and from the context this conclusion must be taken to apply to inclosed fuses) is contrary to the universally accepted laws of fuse design by the best known engineers who have given this subject a study.

The practically verbatim copy of the Underwriters' rules which the article contains can certainly not be looked upon as embodying new and important discoveries, since these rules have been in public print in their present form since 1905 and have undoubtedly been read by the great mass of the readers of your paper.

The author states that he has examined the action of zinc, tin, copper, aluminum and magnesium, and three insulating materials, manganese dioxide, slaked lime and borax, and from these very limited investigations draws the following conclusions: "Any metal may be used as a fuse strip, and if conditions are properly adjusted, the fuse will blow at a fairly definite overload." These conclusions are quite incorrect according to the general accepted practice. The fact is that no metal of high melting point such as copper can be used in inclosed fuses, except possibly in those of very low ampere capacity, since the temperature rise will go far beyond that permitted by the Underwriters or permissible in inclosed-fuse design.

The author states that "the controlling features are relative values of length, width and thickness of the strip, together with the amount and kind of insulating powder surrounding it." In this conclusion he has entirely overlooked what is unquestionably one of the most important features of all fuse design particularly applicable to fuses of large capacity, which has been so carefully investigated and so repeatedly proved that it has now become a recognized law of fuse design by all engineers, and that is the volume and distribution of the metal and extension of its surface within the filling.

Contrary to the author's conclusions that all metals give equally clear breaks, there is a marked difference in the character of breaks of permissible fuse metals. Some alloys can be produced which at temperatures below the melting point break owing to crystallization. Other metals or alloys are wholly unsuitable for fuse use, although of low melting point, owing to the fact that they will remain in a molten condition within the filling without rupturing the circuit unless special precautions are taken to guard against such a contingency.

A further conclusion in regard to what is termed "the insulating powders," or what is commonly known as filling, is erroneous in that it conveys the idea that practically any filling can be employed provided it is a good thermal conductor. This is contrary to the accepted laws. Certain materials which have a very high thermal conductivity are known to be wholly unsuitable for filling owing to the fact that their physical form or chemical composition unsuits them for this purpose.

The conclusion reached regarding the load that a fuse will carry apparently entirely ignores the subject of the area of the fuse and the radiation factor which has so important a bearing on this subject.

The author's final conclusions "that fuses at their best are very unreliable, and no two fuses except by chance will operate in the same way," is certainly quite contrary to the conclusions he has already reached in the earlier portion of his article, viz., "that fuses will blow at a fairly definite overload." The deviation in blowing time the author states "will usually be 25 per cent of the average." While not admitting this to be the fact, since I know it is perfectly possible to construct fuses with a degree of accuracy which is considerably greater than the Underwriters require, the important consideration from the user's standpoint is what possible difference it could make if a fuse did vary two or three seconds in its blowing time at, say, 100 per cent overload. The author has apparently overlooked the fact that the Underwriters have very carefully specified the blowing time at specific overloads of 50 per cent. In the 0-to-30-amp class one minute is the maximum time allowable. Suppose a fuse does blow with fifteen seconds variation in time as compared with another, and still within the one-minute limit, it is difficult to see how that in any way affects its value as a protective device, as the variation is far too small.

It is the practice of the Underwriters' Laboratories to test frequently the product of fuses made by the manufacturers on their approved list. At frequent intervals they go out into the open market and purchase fuses from stock, and these frequent tests check in a most effective way the product of all of the factories. Far from being the absolutely unreliable devices Dr. Somerville would indicate, fuses are constructed on accurate and definitely accepted rules. As in every other class of apparatus, failures occur, but the total number is such a relatively small percentage of the total number of fuses produced and in service as to bring the standard of fuse construction into the class of high-quality material.

L. W. DOWNES,
Manager D & W Fuse Company.

Providence, R. I.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Electro-Mechanical Waterwheel Governor

The accompanying photograph and sketch show an original electro-mechanical waterwheel governor which is in successful operation, giving very close speed regulation, at the hydroelectric plant of the St. Croix Power Company, Somerset, Wis. This station supplies energy to the St. Paul (Minn.) Gas Light Company's electrical system.

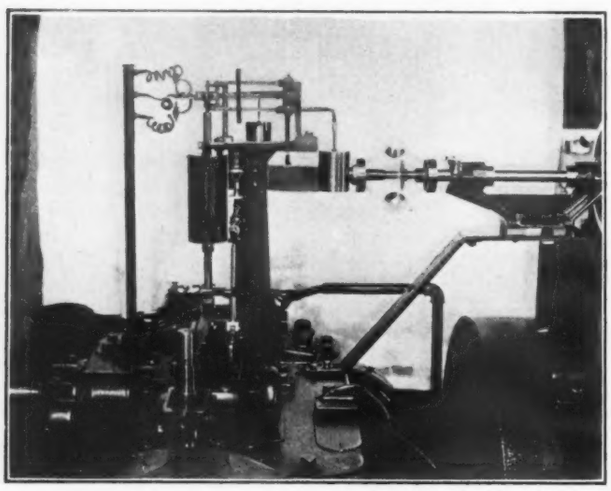


FIG. 1—ELECTRIC GOVERNOR, ST. CROIX POWER COMPANY PLANT, SOMERSET, WIS.

The governor was devised and built by Mr. John Pearson, superintendent at Somerset, and is the subject of patents recently granted him.

In this governor centrifugal fly-balls actuate electrical contacts which, through a clutch, control a differential gearing device operating the gate motion. The fly-balls as shown are very light, since they are required to do no work except operate the floating contacts through the crank-arm. To reduce the current strength required here and to eliminate arcing, the fly-ball contacts simply control relay contactors which are also energized from the machine exciter circuit. The current carried by these secondary contactors approximates 4 amp at 110 volts for each of the clutch-actuating magnets, and to reduce such arcing as might occur condensers are bridged across the latter gaps. Depending on which operating solenoid is energized, the corresponding wheel and worm are engaged by the armature, thus deriving mechanical power from the main turbine shaft to work the gate shaft, and opening or closing the gate as required.

The sketch makes clear the mechanical arrangement. The main generator shaft, running at 300 r.p.m., is geared to the worm shaft through an intermediate pinion. The worm shaft serves as the spindle for free-running sleeves carrying right-hand and left-hand worm gears and leather-covered friction disks. Through these friction disks either worm can be driven by the shaft, depending on which direction the armature lever applies pressure. Each worm drives its corresponding differential gear (with both of which the gate-actuating shaft is meshed), so that the gate shaft can be driven in either direction as determined by the movement of the armature lever and the engagement of the friction clutches. Provision is also made, with the aid of springs, for effecting the centering of the armature arm. This centering arrangement keeps the armature in position when not operated upon by the magnet coils. Outside of the centering mechanism are friction brakes which interrupt the friction drives when disengaged by the armature movement.

It was to insure the noiseless operation of the governor that worm gears were used, while to render the apparatus sensitive to rapid starting and stopping friction drives were employed. The epicyclic or differential gears at the reverse motion were selected in order to secure positive action, free from pawls, ratchets, springs, etc.

To start the waterwheel controlled by this governor, the gate need be opened by hand only enough to cause the waterwheel to turn; this is accomplished through a hand-shaft and gear, not shown. After the machine is moving, the remaining starting governing action can be secured by power through pushing on the friction disks with the aid of a special handle. Excellent lubrication of all parts is secured by inclosing the worm gears and other fast-running pinions in tight housings filled with oil.

Inserted in the primary control circuits will be noted limit contacts which are actuated by the gate movement. One contact cuts out the opening-magnet circuit as soon as the gate has reached its full aperture. The other prevents further operation of the closing magnet when the generator is running without load at full speed. This stop is essential; for in case of sudden interruption to the load, caused by operation of circuit-breakers, fuses or other accident, the governor will hold the machine down to normal speed until the operator can reach it. Again, in case several wheels are in service pulling synchronous alternators paralleled, the gate will be promptly closed so that no machine will be operated as a motor.

The compensatory or anti-racing device is also of special interest. The feature of this is an ingenious dash-pot

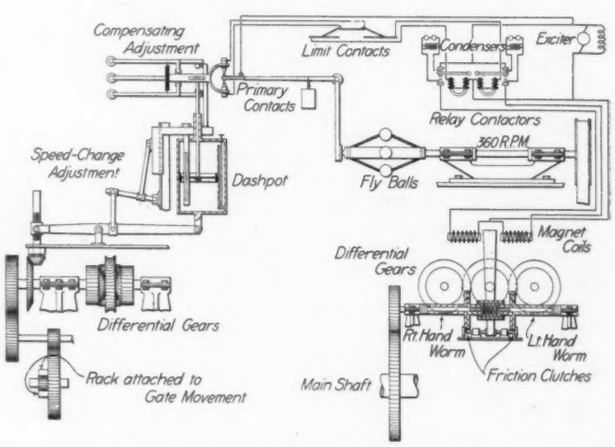


FIG. 2—DIAGRAMMATIC ARRANGEMENT OF GOVERNOR PARTS

mechanism with a slotted piston and valve partition which by-passes oil when the piston is removed from its center position. A system of springs, rollers, arms, etc., acts to return the dash-pot to its central position when diverted from normal. As this compensating dash-pot is mounted in a vertical position, no stuffing box is needed for the piston. The compensating mechanism thus operates to

interrupt the fly-ball control contact as soon as the required speed change has been accomplished, at once opening the actuating contact and preventing over-travel of the gate motion. But if a very large load change has taken place suddenly, the piston, in its effort to stop the gate movement, will pass considerably above the partition in the pipe valve, thus allowing the oil to by-pass and reducing the action of the piston. In other words, the anti-racing device opposes the action of the fly-balls, but as the speed varies more and more this opposition is less and less.

In the system of levers connecting the dash-pot with the gate motion is a speed-changing or equalizing device, by means of which through lengthening or shortening the rod by the double thumbscrew, the load on the wheel may be increased or decreased at will when running in parallel with other machines.

Home-Made Commutator Truing Rig

In a great many stations the usual practice in turning down commutators is to remove the armature entirely from the machine and place it in a lathe, if one be available, or else send it to some nearby machine shop. In either case the machine is useless until the armature is reset, and ignoring entirely the annoyance of taking the machine apart and the bother of replacing the armature in its exact position again, the time lost plus the actual cost of turning down the commutator every once in a while is no mean item of expense. In the station of the Renovo Edison Light, Heat & Power Company at Renovo, Pa., recourse is had to home-made rigs which serve the purpose excellently and have moreover the added advantage that the work of turning down the commutator can be done without removing the armature from the machine at all. Nor is the rig intricate or expensive; it merely represents the ideas of a practical man desirous of avoiding the necessity of dismantling a machine every time a commutator has to be turned down. For this

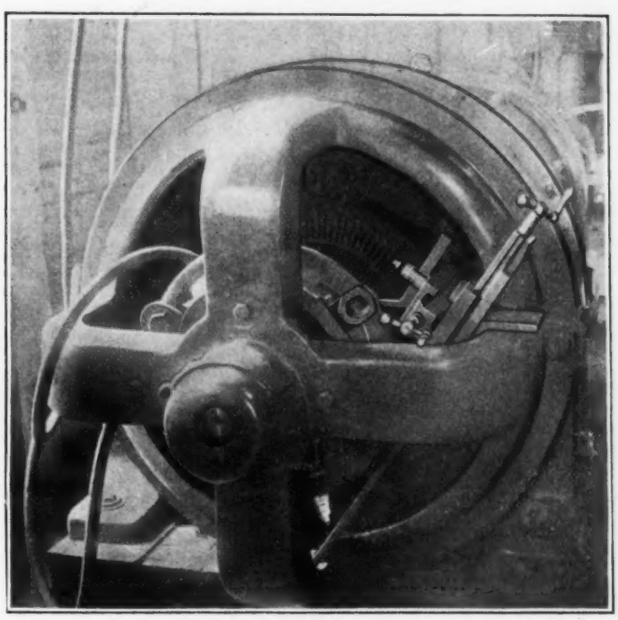


FIG. 1—APPLICATION OF LATHE REST

purpose use is made of a lathe rest having a sufficient range to turn down any commutator up to one 22 in. wide, without readjustment or realignment.

Fig. 1 shows the lathe rest fastened to an iron brace for use in turning down the commutator of a 110-hp motor. The illustration shows how the frame of the machine can be used as a support for the rig. The brace and rest are shown applied to the armature frame and ready for use, except that the rest is not lowered to the center of the commutator as in operation; otherwise a full view of the device could not be obtained. Just enough brush-holders need be removed to allow room for the brace and rest.

The same lathe rest applied to a different type of machine in the station at Renovo is shown in Fig. 2. Here two cast-

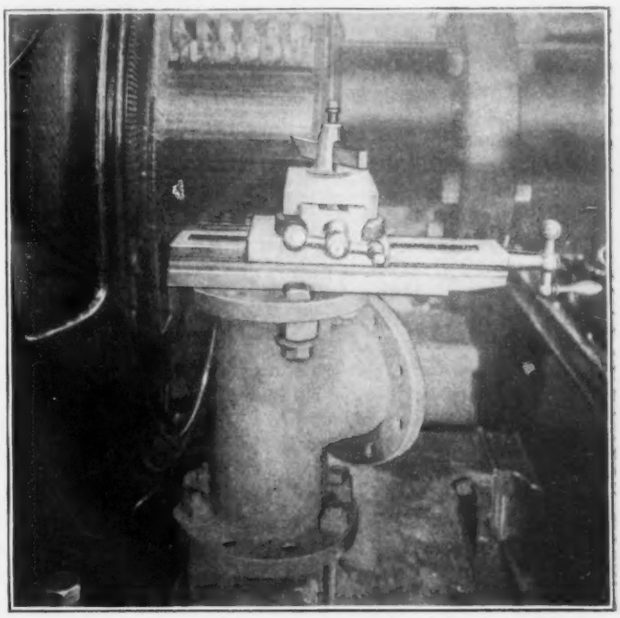


FIG. 2—LATHE REST BLOCKED UP FOR OPERATION

iron tees were taken from the scrap heap and bolted together with a hard-wood block between them to get the proper height. A brace of wood extending from the top flange of the tee to the opposite side of the base frame of the machine is used to stiffen the tees or tool post. Holes were drilled in the base frame of the machine and the tees bolted to it. This rig was got up in an emergency eight years ago, and it worked so well that the wooden brace is now replaced by an iron brace and the emergency truing device made a permanent affair.

The time required to set up the lathe rest, turn off the commutator and take down the tools varies from two to four hours, depending on the size and condition of the commutator. The tool may be used right-handed or left-handed, and the entire cost of the lathe rest, tools, brace and post was about $40. The cost of removing one 110-hp motor armature and putting it back ready for use would be at least $30, besides the inconvenience and risk of damaging the armature. This cost means the dismantling of the machine without the aid of a crane. Mr. F. M. Noecker is the general manager of the Renovo station, which, although small in size and output, has many features of interest not possessed by much larger stations.

Converting a Motor from a 60-Cycle to a 133-Cycle Machine

What changes are necessary in order to convert a 5-hp, three-phase, 440-volt, 60-cycle, 900-r.p.m. motor to a 133-cycle machine? The primary winding is arranged with eight poles in series per phase, star-connected.

N. H.

When rearranged for sixteen poles the speed will be about 1000 r.p.m., which should be satisfactory. Make the coil-throw one-half the present value, thus giving a pole surface one-half of the present area. With all coils in series per phase, star-connected, the voltage per turn will be the same as before and the core flux density about 90 per cent of the former value, which should prove fairly satisfactory.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

High Angular Speeds.—Maurice Le Blanc.—A long illustrated paper on the realization of very high angular speeds. In the first part of his paper the author points out the importance of high speeds of about 30,000 r.p.m. for the construction of steam turbines of low capacity with a single wheel, or of alternators driven by such turbines, or of rotary compressors. In the second part the author shows how these enormous angular speeds can be realized without causing trouble if the rotor is permitted to choose at will its axle of rotation. In the third part the author studies the devices which permit the equilibrium of the rotor to be re-established automatically when this equilibrium is being disturbed by centrifugal forces.—*Bull. de l'Assoc. Techn. Maritime,* No. 23, 1912; abstracted in *La Revue Elec.,* Jan. 17, 1913.

Heavy Electric Engineering.—F. Niethammer.—A continuation of his long lecture before the Electrical Society of Vienna on comparisons of heavy electrical engineering in the United States and in Europe. In the present instalment the author deals with oil switches and protective devices on overhead lines and passes over to a discussion of electric lighting and heating.—*Elek. und Masch.* (Vienna), Feb. 2, 1913.

Return-Energy Testing of Direct-Current Traction Motors.—With reference to the recent article of W. E. French, F. M. Denton writes that the return-energy, or "pump-back," method of testing as applied to direct-current railway motors is by no means new and gives diagrams of the arrangement of the test as it is usually carried out by the General Electric Company at Schenectady, N. Y. G. W. O'Howe writes that the application of the Hopkinson test to series motors is looked upon as a standard in many works.—London *Electrician,* Jan. 31, 1913.

Armature Construction.—R. Livingstone.—The conclusion of his article on some mechanical points in armature construction. In the present instalment the author deals especially with the unbalanced magnetic pull on rotors.—London *Electrician,* Jan. 31, 1913.

Transformers.—J. Reyval.—An illustrated article on the construction of single-phase transformers with special reference to the losses. He shows that for certain cases transformers with as small no-load losses as possible must be used while in other cases the no-load losses are of small practical importance as the design must be adapted to the conditions according to the requirements of the case.—*La Lumière Elec.,* Feb. 1, 1913.

Lamps and Lighting

Metallic-Filament Lamps Versus Arc Lamps.—Paul Stahl.—An article on the present strong competition between metallic-filament lamps and arc lamps. The metallic-filament lamp has already captured a considerable part of the field formerly held by the arc lamp, but the arc lamp maintains its strength for exterior lighting, street lighting, lighting of railroad depots, etc., though even in these fields the large metallic-filament lamp will in time become popular. For interior lighting and for show-window lighting the metallic-filament lamp has practically replaced the arc lamp and many of its advantages shown there will also count in exterior lighting.—*Elek. Anz.,* Jan. 26, 1913.

Intrinsic Brilliancy of the Glowworm.—H. E. Ives and C. W. Jordan.—An abstract of an American Physical Society paper. Even more important than the luminous efficiency of the glowworm is the intrinsic brightness of the light emitted. A species of glowworm was studied for this purpose on account of giving a steady glow from its luminous abdominal areas. The brightness of these spots was compared directly with that of a white blotting paper illuminated by a 10-cp standard incandescent lamp. By proper manipulation of the glowworms their bright areas were visible directly against the white surface, with no dividing line, making possible a very close match by moving the incandescent lamp to and fro. It was found that the luminous spots were as bright as the blotting paper under an illumination of 190 meter-candles, or considerably brighter than white surfaces are ordinarily when illuminated by artificial light (about 25 meter-candles). Taking the albedo of blotting paper as 0.76, it follows that the candle-power per square centimeter of the glowworm is 0.0046. In order, therefore, to obtain 25 meter-candles on a plane 2 m below a light source, the latter would have to be about 2 sq. m in area. The source would give 100 cp, which should be sufficient to illuminate a room having five times the area just stated. A peculiarity of most instances of chemi-luminescence is their excessively low specific brightness. On the other hand, most artificial illuminants are of such excessive brightness that the light must be spread over a greater area by the use of diffusing glass or reflecting surfaces. The intrinsic brilliancy of the glowworm lies between these extremes. It appears, therefore, that the solution not only of the problem of light efficiency but also of that of light intensity may follow from copying the process exhibited by the firefly.—*Phys. Review,* January, 1913.

Generation, Transmission and Distribution

Blackburn.—An illustrated article on the electricity supply of Blackburn, England. A sketch of the history and gradual development of the station is given. There are installed fifteen generators of various types and makes, all driven by reciprocating engines. These generators deliver either direct-current or alternating-current energy directly to the mains for meeting the lighting demands. In connection with a motor-generator which raises the voltage from 440 to 500, they also supply energy for traction, a battery and booster which are connected across this motor generator preventing the lighting voltage from being unduly disturbed. To satisfy the recent considerable increase in the motor load, extensions have been provided, consisting of two 2000-kw high-pressure, impulse-type turbo-alternators which, when running at 3000 r.p.m., generate three-phase currents at a pressure of 6000 volts and a frequency of 50 cycles.—London *Electrician,* Jan. 31, 1913.

Pump.—The difficulties attending the pumping of liquids holding solids in suspension are mentioned, and a description is given of a new pump, designed by R. C. Parsons, which by means of a knife blade cuts up solids which are passed into it. Its applicability for drainage work is pointed out, and a description is given of some tests which it has undergone.—London *Electrician,* Jan. 31, 1913.

Electricity in Tin Mines.—H. Thieme.—The conclusion of his descriptive article on the hydraulic and hydroelectric plant of a tin mine in Ulu Guroh, Tekkah, India, with notes on the advantages of electricity in tin mining.—*Elek. Zeit.,* Jan. 30, 1913.

Traction

Single-Phase Locomotive.—VAN CAUWENBERGHE.—An illustrated translation of his recent German paper on the 1500-hp, single-phase Jeumont locomotive used on a French line.—London *Electrician,* Jan. 31, 1913.

Installations, Systems and Appliances

Association of Austrian and Hungarian Central Stations.—An account of the ninth annual convention of the Association of Austrian and Hungarian Central Stations held last year in Salzburg. The association has ninety-two ordinary members, representing 105 stations, and five extraordinary members. Lederer read a paper on the tungsten lamp, Beron one on fuses, Hartmann one on the competition which has arisen to central stations from coal mines, and Kvetensky one on the position which the Austrian post and telegraph department is taking with respect to high-tension overhead lines. A report was presented by the committee on first aid in case of electric accidents. Dr. Jellinek emphasized the importance of practical resuscitation and reported on the good results he had obtained with the pulmotor. Methods of propaganda to further the use of electricity and various problems of bookkeeping in central stations, especially depreciation, were discussed.—*Elek. Zeit.,* Jan. 13, 1913.

Lighting Battery for Central Stations.—An account of the discussion which followed the recent paper of F. H. Whysall in London on the use of a large lighting battery in connection with central stations. J. S. Highfield emphasized that of first importance is the greater security insured by the battery. The advantage of the battery from the point of view of taking the peak load is rather in the opposite direction to its advantage from the point of view of security, because if an accident happened at the time of peak load the battery would be partly run down, and therefore the battery can really be only partly used for both purposes. Nevertheless, he is quite satisfied about the value of large batteries. The method of control is of the greatest importance and would permit of much discussion, but for a general lighting and motor load he thinks that the best solution is the use of a hand-controlled booster for charging and discharging, and he would also like to have a short-circuiting switch, so that in the case of a very bad accident it could be rapidly closed and the booster saved from destruction. A. M. Taylor said that the practical results given by the author confirm his theoretical results as to the saving in coal. He disagreed with the opinions recently expressed that the battery is of no use because of the large extension of alternating-current plant, and he considers that the battery is really valuable in a station that combined alternating-current distribution with continuous-current supply. Considering all the saving to be effected by the battery, it would pay to introduce rotary converters capable of operating reversely, using them to take the enormous discharge from the battery and to send it to the alternating-current mains, using it as an alternating-current standby. R. T. Smith gave figures on the battery of the Great Western supply station at Port Royal for traction or lighting. The maximum load on the generating station with batteries is 2720 kw, while without the batteries it is 3870 kw. The station load with batteries is actually taken by three steam sets, whereas without them five steam sets would have been required. The daily load-factor on the steam plant with the batteries, corresponding to the figures given by the author, is 58 per cent, and without the batteries 41 per cent, showing an improvement in load-factor of 17 per cent. Of course, the percentage gain in load-factor due to a battery simply depends on the percentage of the total output passing through the battery. He would suggest that the most economical amount of the total output to go through the batteries is between 15 per cent and 20 per cent. C. P. Sparks said with regard to the position of the battery that, so far as a general supply is concerned, he is of opinion that it should be placed in the substation instead of in the generating station.—London *Electrician,* Jan. 31, 1913.

Electricity Supply.—G. W. MEYER.—The first part of a review of the present status of electric energy supply and prospects of further developments. The author sketches the development from the pure direct-current system to the three-phase system and the combined three-phase and direct-current system, the introduction of turbo-generators into central stations, and the evolution of the very large central station.—*Elek. Anz.,* Jan. 13, 1913.

Propaganda for Electricity.—E. WIKANDER.—A lecture given before the Electrical Society of Vienna on new tendencies in the propaganda for electricity and on other means to encourage greater sale of electrical energy and electric apparatus.—*Elek. und Masch.* (Vienna), Feb. 2, 1913.

Wires, Wiring and Conduits

Aluminum Cables.—An abstract of a report of E. d'Hoop, presented at the Christiania convention of the International Tramway and Light Railway Association. The use of aluminum cables seems to be developing and merits special attention. Eight undertakings report that they have them in use, namely, Copenhagen Municipal Tramways, Geneva Tramways Company, Lausanne Tramways, Lyons Tramways & Omnibus Company, Nuremberg Municipal Tramways, Nogentais (Paris) Company, the Paris General Omnibus Company and the Société Nationale des Chemins de Fer Vicinaux de Belgique, Brussels. The last-named company uses only aluminum cables for high-tension alternating current. On the other hand, the cable manufacturers who have replied mention numerous examples of the adoption of these cables for both high tension and low tension. The proportion admitted between the useful section of aluminum cables in comparison with copper cables of the same conductivity oscillates around 1.65. The useful section of cables used for low tension frequently exceeds 1000 sq. mm, the maximum mentioned reaching 1700 sq. mm. The Siemens-Schuckert Company gives a description of the installation of a cable with a single aluminum conductor for single-phase current at 60,000 volts on the Muldenstein-Bitterfeld section of the Prussian State Railways. The first application of these cables was at Rennes in 1901, but the extended use of them dates back three to five years only. All who have adopted these cables state that they are satisfied with them, and no practical drawbacks have been experienced. The making of the joints and connections, however, necessitates the exercise of special care, owing to the low conductivity of the oxide of aluminum, which may form on the surfaces of the pieces to be connected. The ends to be joined should be cleaned most carefully, branch sleeves of large contact surface used, and the joint made as rapidly as possible so as to limit the effects of the air. The fear has been expressed that, owing to the considerable capacity of aluminum cables, the increased effects of resonance may cause piercing of the insulation in case of a sharp break in the circuit; but so far nothing of the kind appears to have occurred with those companies which have these cables in use. The desirability of using aluminum cables, in comparison with copper, depends principally on pecuniary considerations and the relative market prices of the two metals. However, there is an advantage in using aluminum for cables of large section for continuous current. In some instances the economy thus secured exceeds 14 per cent. According to a formula worked out by the Copenhagen Tramways, the use of aluminum is advantageous when the price of aluminum in pounds per ton is lower by 2.08 $\times$ price of copper — 30. This formula evidently assumes the parity of the price of lead, iron hooping and the other materials used in the manufacture of cables. Independently of the question of price, aluminum cables have the advantage, in the case of very high tension, when it is necessary to augment the section of the conductors in order to increase the dielectric rigidity.—London *Electrician,* Jan. 31, 1913.

Electrophysics and Magnetism

Elementary Electric Charge.—R. A. Millikan.—An American Physical Society paper giving a summary of the results obtained in the work of the past two years in the determination of all of the factors entering into the oil-drop method for the evaluation of the elementary electric charge. The final result is that this elementary electric charge equals $4.774^2 + 0.008 \times 10^{-10}$ electrostatic units.—*Phys. Review,* January, 1913.

Resistance of Carbon Contacts.—A. L. Clark.—The author has found that the resistance of carbon contacts varies to a remarkable extent, not only with pressure and current, but also with the time and in a very regular manner. This regular variation with time after eliminating the effect of change due to a rise of temperature seems to have escaped notice formerly. The author has investigated the time relations of changes in resistance in carbon contacts, such as are commonly used in telephone transmitters. Experiments were made on carbon in the form of grains, balls and plates, always with the same results. The experiments were made both for loose and for tight contacts, and the results are given in tables and diagrams.—*Phys. Review,* January, 1913.

Emission of Electrons from Hot Bodies.—H. L. Cooke and O. W. Richardson.—An abstract of an American Physical Society paper giving an account of experiments made with osmium filaments in order to establish the existence of the cooling effect which accompanies the emission of electrons from hot bodies. The experiments appear conclusively to demonstrate the existence of the effect under investigation.—*Phys. Review,* January, 1913.

Resolving Periodic Curves.—Friedrich Meurer.—A mathematical article, illustrated by diagrams, in which the author describes a new method for resolving a periodic curve into its fundamental wave and higher harmonics, according to the Fourier series, by means of drawing parallel lines to the time axis. An analytical method or a graphical method may be employed for completing the process. Symmetric half-waves are best resolved by means of the graphical method, non-symmetric half-waves by the analytical method.—*Elek. Zeit.,* Jan. 30, 1913.

Electric Conductivity of Glass and Quartz Crystals.—R. Ambron.—An account of careful measurements within a large temperature interval of the resistance of glasses of simple chemical composition as a function of the composition and as a function of the temperature. The electric resistance of quartz crystals was also measured to determine how it depends on the angle of the plane of the sample under test with respect to the crystallographic axis.—*Phys. Zeit.,* Feb. 1, 1913.

Physical Review.—This journal, founded in 1893, was transferred by its editors (E. L. Nichols, E. Merritt and F. Bedell) and by Cornell University, which had assumed the financial responsibility for the publication, to the American Physical Society with the beginning of this year. F. Bedell is to be the managing editor.—*Phys. Review,* January, 1913.

Units, Measurements and Instruments

Myriawatt.—An editorial criticising the proposal by H. G. Scott and H. O'Neill to recognize a new unit, the myriawatt. "We fail to see any substantial ground for the introduction of the proposed new unit. The idea is that it will facilitate the expression of over-all efficiency; that the input of heat at one end of a transforming system consisting, for example, of boilers and turbo-generators will be expressed in myriawatts and the output in kilowatts, and consequently the over-all efficiency will be found very easily. But it is surely much more rational to use the kilowatt all through for such a purpose. The sole ground with a shadow of reasonableness in it for the introduction of this new unit is that the myriawatt is very nearly equal to a 'boiler-horse-power,' one of those illogical units which have no true connection with any other quantity. The 'horse-power' is bad enough in this respect, but it has the respectability of age about it, and it may be treated with some regard on that account. The boiler-horse-power is an American unit based on 30 lb. of steam per hour raised from water at 100 deg. Fahr. to a pressure of 70 lb. per sq. in. It is entirely illogical to have more than one horse-power. . . . Thermally 1 hp is equal to 2547 b.t.u. per hour, but a boiler-horse-power is 33,479 b.t.u. per hour. Obviously there is no sort of relation between the two, though it may be supposed that under certain conditions one boiler-horse-power is capable of producing one mechanical horse-power by means of a steam engine used in conjunction with it. . . . In due time the term 'boiler-horse-power' should disappear like other irrational units. . . . We trust that the Electrotechnical Commission will see the advantages of simplicity and of adopting only those units which are useful rather than ornamental. There is nothing to prevent anybody from rating his boilers in kilowatts, tens of kilowatts or hundreds of kilowatts as he may think fit, but there is no need to complicate literature by unnecessary terms."—London *Electrician,* Jan. 31, 1913.

Myriawatt.—An editorial discussion of the proposal of this new standard. "We cannot refrain from pointing out that to 'standardize' the myriawatt, which is simply a recognized decimal multiple of the standard watt, is as superfluous as to standardize the number ten or ten thousand. It is not standardization at all. What the conference really did was to agree to abolish the 'boiler-horse-power,' a term which has been disused and obsolete in this country [England] for years and years. . . . . We are sure that American engineers will be well rid of this clumsy unit. What we cannot understand, however, is why, in the name of common sense, they want to measure the input by a unit ten times that used for the output. Surely the kilowatt is good enough for both ends of the machine. Have our cousins lost their traditional sense of humor?"—London *Elec. Review,* Jan. 31, 1913.

Iron in Electric Measuring Instruments.—M. Dolivo-Dobrowolsky.—The author emphasizes the disadvantages of delicate instruments and the great advantage which robustness of construction has for the average use. Robustness of construction requires especially robustness of the bearings, and the present tendency to make the revolving part of the instrument as light as possible does not permit this. The author thinks that it is time now to follow the opposite tendency by putting as much iron into instruments as possible. This is done in the "ferrodynamic" instruments of the Allgemeine Elektricitäts Gesellschaft, especially in the wattmeter. They are of the dynamometer type, but contain iron. Fig. 1 shows the arrangement of the iron with respect to the fixed and movable coil of the dynamometer.

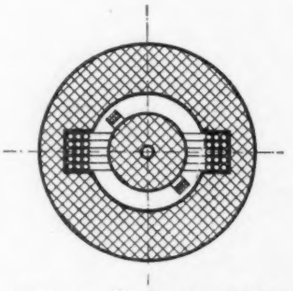
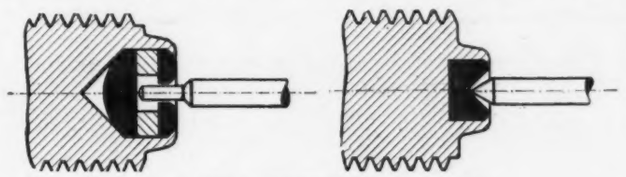


FIG. 1—SECTIONAL VIEW OF DYNAMOMETER

With the use of much iron it is possible to increase the torque very considerably so that a much heavier weight of the movable part can be employed. The only disadvantages of the iron are remanences and hysteresis. The author shows that in order to make the error due to remanence negligible it is necessary only to make the number of ampere turns for the magnetization of the iron sufficiently small in comparison to the total ampere turns. In order to make the error due to hysteresis negligible it is necessary only to make the watts lost in the iron small in comparison with the wattless inductive volt-amperes of the coil. In the instruments of the Allgemeine Elektricitäts Gesellschaft the total number of turns is about 200, while less than one ampere turn is needed for the magnetization of

the iron. The remanence is less than 0.5 per cent while the weight of the iron employed is about 300 grams. If this is compared with delicate electromagnetic instruments in which the remanence is also 0.5 per cent while the iron weighs only about 1 gram, it will be found that much iron does not necessarily mean much remanence. The author thinks that this kind of construction is suitable particularly



FIGS. 2 AND 3—INSTRUMENT BEARINGS

for wattmeters rather than for voltmeters or ammeters. The torque is 0.8 gram-centimeters; that is, double the usual torque. In cases where the instruments may be subjected to vibrations, etc., this greater torque permits using journal bearings (Fig. 2) instead of pivot bearings (Fig. 3). The two illustrations show these two types of bearings for two instruments otherwise identical. The journal-bearing construction is far more robust, and there are no errors due to adjustment or friction. The high torque is also of great advantage in recording instruments. Since these instruments are completely incased in iron, they are not affected at all by external electromagnetic fields.—*Elek. Zeit.*, Jan. 30, 1913.

Measuring the Degree of Irregularity of Speed of Alternators During One Revolution.—P. BOUCHEROT.—For parallel operation of alternators the degree of irregularity of speed during one revolution is important. It is defined as $e = (S_{max} - S_{min}) \div 2\, S_{mean}$, where S_{max} is the maximum instantaneous angular speed during one revolution, S_{min} the minimum instantaneous angular speed, and S_{mean} the mean instantaneous angular speed. To measure the degree of irregularity e the author uses a galvanometer which has a period of oscillation very nearly equal the period of the alternating current produced by the alternator under test, the period of oscillation being adjustable by very small degrees at will. A flat coil A is mounted on the center of a U-formed elastic ribbon B (Fig. 4), in a magnetic field normal to its plane. The coil A is connected to the alternator through the intermediary of a large resistance, the current being of the order of magnitude of one-tenth of an ampere. The ends of the ribbon B, which is bent into U-form, are mounted in the blocks CC, and the distance between them may be varied by means of the screw D so as to enable one to vary the period of oscillation within the

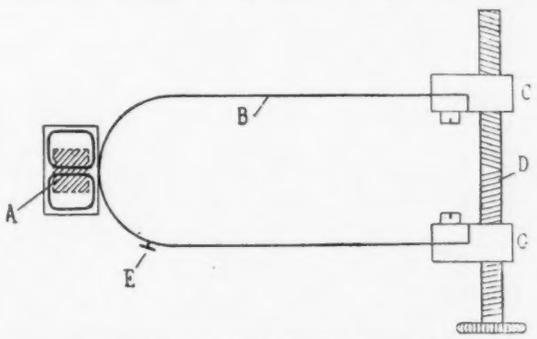


FIG. 4—DEVICE FOR MEASURING SPEED VARIATION

desired limits. A concave mirror E, an incandescent lamp which serves as source of light for the mirror, and an ordinary transparent scale complete the apparatus. During one revolution of the alternator, the frequency varies between the limits $F\ (1+e)$ and $F\ (1-e)$. If now the natural frequency Fp of the galvanometer is adjusted so that it is equal to F, the light spot on the scale has a constant length which may be α for a resistance R in the circuit of the galvanometer. But if Fp is adjusted so that $Fp = F\ (1 + 1/p)$ or $Fp = F\ (1 - 1/p)$, where p is the number of pairs of poles of the alternator, the light spot on the scale changes periodically its length with the frequency F/p; it surges. Its extreme values during surging may be, for instance, b and c for a resistance R_1 in the circuit of the galvanometer. (If in this second experiment the same resistance R as in the first experiment were used, the values of b and c would be smaller and the difference $b - c$ could not be read with as great accuracy; for this reason it is preferable to use in practice a resistance R_1 from one-tenth to one-fifth of R.) The degree of irregularity is then given by the formula $e = (b - c)\, R_1 \div (\alpha\, p\, R)$. Details are given of application of this method and of its mathematical theory.—*La Revue Elec.*, Jan. 17, 1913.

Telegraphy, Telephony and Signals

Telegraphy and Telephony.—DEVAUX CHARBONNEL.—A review of developments during 1912 with special reference to the effect of single-phase traction lines on telephony.—*La Lumière Elec.*, Feb. 1, 1913.

Disturbances of Telephone Lines from Three-Phase Lines.—O. BRAUNS.—The first part of a mathematical article illustrated by diagrams on disturbances of telephone lines caused by star-connected three-phase systems when the neutral point of the generator is earthed or not earthed. —*Elek. Zeit.*, Jan. 30, 1913.

Wave Detector.—An illustrated description of the Helsby detector, which belongs to the general type of crystal detectors.—*Elek. Anz.*, Jan. 26, 1913.

Wireless Telegraphy.—C. G. CRAWLEY.—An account of observations of wireless "atmospherics" in the Mediterranean. The chief results are as follows: The number of times strong "atmospheres" were observed during night watches was very great compared with that during day watches; that is, from 70 per cent to 30 per cent. The percentage of watches when strong atmospherics were prevalent was almost exactly the same as that for slight atmospherics.—London *Electrician*, Jan. 31, 1913.

Wireless Receivers.—A note on a recent British patent (86, 1912) of G. Marconi and C. S. Franklin. A series characteristic generator, with its magnetic parts, unsaturated, is connected in series with a battery and a Fleming valve, carborundum or other crystal detector. The generator at a certain speed causes the increase of current which always takes place at a certain potential difference to become much more rapid. The strength of signals in the receiver is thereby greatly augmented, owing to the increase in pressure produced by the incidence of a wave. The increase in current is limited only by the saturation current of the detector, but it does not decrease again on the removal of the extra applied potential difference, and hence a second relay is inserted in the indicating circuit to break the generator and detector circuit as soon as the current in it is sufficient to work the first relay.—London *Elec. Eng'ing*, Jan. 30, 1913.

Book Review

METAL STATISTICS. Published by the *American Market and Daily Iron and Steel Report*, 81 Fulton Street, New York. 255 pages.

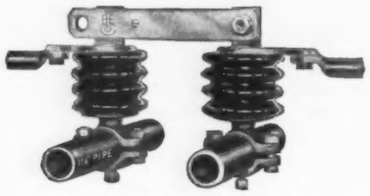
The sixth annual edition of this little book, containing 1912 statistics of all the metals, was issued recently. In addition to giving the 1912 production, price changes, etc., it contains a vast quantity of data in a concise, tabular form which should make it of great value for reference purposes. The present edition has many improvements over its predecessors as regards completeness and arrangement of the information presented.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Double-Blade Disconnecting Switch

A new type of disconnecting switch, which is claimed to make better contacts between the switch blade and the studs, has recently been placed on the market by the Electrical Engineers' Equipment Company, 10 North Desplaines



DISCONNECTING SWITCH

Street, Chicago. The usual pair of clips and single blade have been supplanted by a solid copper tongue, cast integral with the base, and a double blade, the two parts of which are separated so as to close firmly over the tongues. The blades are adjustable so as to allow for wear on both tongues and blade. The construction is clearly shown in the illustration. The line of standard switches includes sizes from 300 amp to 2000 amp and from 2000 volts to 33,000 volts for either pipe or flat steel-base mountings.

Self-Contained Electric Pipe-Thawing Outfit

For thawing frozen water pipes at distances from the central-station supply lines where the carrying of long taps becomes cumbersome or difficult the Columbus (Ohio) city water department has developed and had built a special self-contained pipe-thawing outfit comprising a 30-kw gasoline-engine-driven generator set which is carried on a 2.5-ton motor truck. At the close of the winter season the engine set can be demounted from the truck body by removing the channel bolts and the truck utilized for other purposes.

PORTABLE PIPE-THAWING OUTFIT

The four-cylinder four-cycle engine is rated at 50 hp at 800 r.p.m. and drives the 30-kw generator through a flexible coupling. The latter unit has a current output of 300 amp at 100 volts or 400 amp at 75 volts. A special governor permits engine-speed control within the range from 250 to 850 r.p.m. The radiator is designed for continuous operation at full load, natural dissipation of heat being supplemented by a 24-in. fan mounted on an extension of the engine shaft. Cooling water is circulated by a pump.

The switchboard, mounted between the engine and generator, carries a voltmeter and an ammeter, field rheostat, main switch and overload circuit-breaker. All elements of control are thus brought within easy reach of the operator without moving from his position.

Suspended from hangers beneath the right-hand side of the truck body is the conductor reel, which carries two 210-ft. lengths of 300,000-circ. mil cable. Collector rings and brushes convey the current to these pivoted reel conductors. Special bronze clamps have been constructed to make proper electrical contact on any size of pipe between 0.375 in. and 2.5 in. in diameter by means of hand-nut adjustments. Other contacts are provided for making connection to hydrants, bib-cocks, etc. All parts can be assembled by hand-nuts without the use of tools.

The equipment was completed only this season and has not yet been used in service, owing to the mildness of the present winter, but according to Mr. C. P. Hoover, chemist for the local water-purification works, it is expected the outfit will be able to thaw as many as forty services a day if necessary. Mr. Jerry O'Shaugnessy is superintendent of the Columbus water-works division.

Electrically Operated Ice-Cream Plant

The factory of the Lifter Ice Cream Company, Philadelphia, Pa., which has the remarkable output of 10,000 quarts of ice cream per day, is equipped throughout with electric drive, a total of seventeen motors with an aggregate rating of 139 hp having been installed. Most of these motors are utilized for refrigerating purposes. No ice is used except for the preservation of the ice cream in its frozen state during its transportation from the factory to its destination.

The refrigeration is produced by a 30-ton York refrigerating machine connected by means of chain drive to a 60-hp, three-bearing, adjustable-speed induction motor, as shown in the illustration.

The mixing machine, belted to a shaft driven by a 10-hp motor, which also drives the cooling apparatus, prepares the cream and forces it through a series of cooling coils into six 40-quart individual freezing machines, each driven by a 3-hp induction motor. The cylindrical freezer is surrounded by a brine jacket, the brine being kept in constant circulation by the brine pump, which is driven by a 10-hp motor. When the cream reaches a consistency which will just permit of its being poured it is drawn out of the freezers into the ice-cream cans.

An interesting feature of this installation is the method of determining when this consistency has been reached. This is accomplished by the installation in each freezer-motor circuit of an ammeter which shows the current taken by the motor driving that particular freezer. Of course, as the cream hardens the motor performs more work, which is indicated by the ammeter needle. The ammeter scale is graduated to show the consistency of the cream.

The cans containing the frozen cream are placed in a large refrigerating room with a temperature of about 6 deg., where they are kept over night and dry-hardened. Every morning the cans are transferred from the cold room and packed in ice and salt for delivery to the consumer or dealer.

Electric motors are also used to drive can washers, sterilizers, ice crushers, pumps, elevators and fans.

ELECTRICALLY OPERATED ICE-CREAM FACTORY

The company has eighty-five employees, twenty-nine wagons and one automobile truck. Nine 2.5-ton motor trucks have been ordered and will soon be placed in service. The motors are all of the induction type, designed for operation on a two-phase, 60-cycle, 220-volt alternating-current circuit, and were furnished by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Energy is obtained from the circuits of the Philadelphia Electric Company.

Vertical-Handle Drum-Type Controller

The location of drum-type controllers sometimes makes operation by a straight backward and forward motion of the operating handle more convenient than the usual rotary motion in a horizontal plane. The Cutler-Hammer Manufacturing Company, Milwaukee, has, therefore, included in its standard line of apparatus a vertical-handle drum-type controller.

The lever has a centering latch, which is released by the button at the end of the handle, as in the case of the horizontal rotating-type lever. The operation of the controller is accomplished by means of a bevel-gear drive, the construction otherwise being identical with that of the standard line of controllers made by this company.

General-Utility Dry Battery

The Western Electric Company has recently placed upon the market a new dry battery, known as the "Red Label Blue Bell battery." It is of the high initial amperage and low internal-resistance type, having an initial amperage of 25 amp on short-circuit.

A few of the most important uses to which it is said to be well adapted are for the operation of call bells, annunciators and electrical toys, for operating telephone pole changers, for railway telephones in furnishing transmitter current on train-dispatching circuits, as selective signaling battery or in operating certain types of interrupters. It is also well fitted for ignition service in general, in conjunction with industrial gas engines, as starting battery for automobiles and with low-speed gas engines, such as are used in motor boats and automobile trucks.

Test of Large High-Vacuum Condenser

A condenser of the dry-tube-base design, manufactured by the Wheeler Condenser & Engineering Company, Carteret, N. J., was recently installed at the South Works of the Illinois Steel Company, South Chicago, Ill., in connection with a 7000-kw Curtis mixed-pressure turbo-generator.

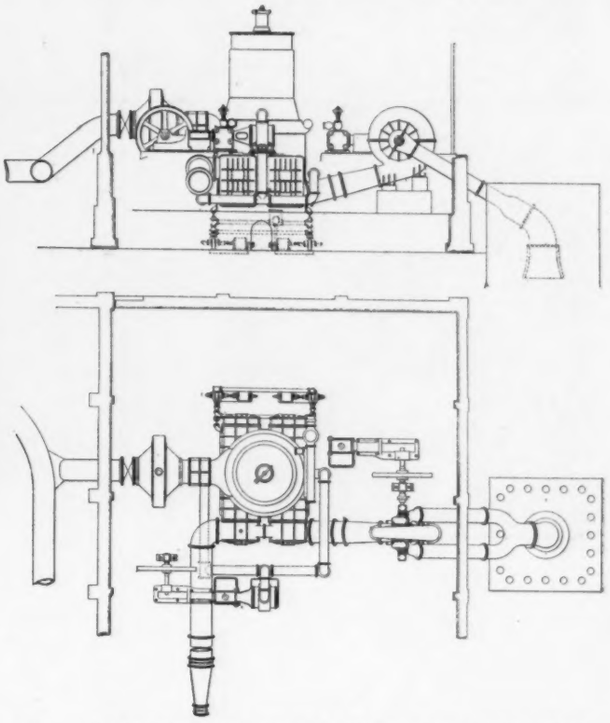


FIG. 1—ARRANGEMENT OF CONDENSER AND AUXILIARIES

Low-pressure steam is supplied by three 2000-kw compound reciprocating engines, which discharge into a header about 100 ft. long. In addition to this supply of steam, the exhaust from blast-furnace blowing engines and auxiliaries is used up to the extent of 200,000 to 250,000 lb. per hour. In case of a deficiency in the supply of exhaust steam high-pressure steam is used to carry the load on the turbo-generators.

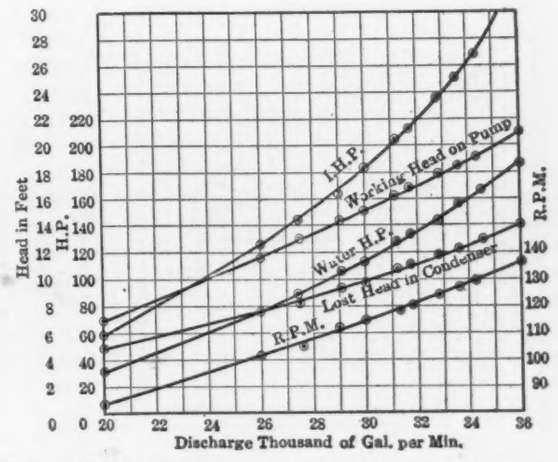


FIG. 2—RESULTS OF TEST ON CENTRIFUGAL CIRCULATING PUMP

The arrangement of condenser and auxiliaries is shown in Fig. 1. The condenser-tube surface is arranged in two sets of banks on either side of the center line with dry plates at several elevations on each side draining outward toward the shell. They divide the tube surface into a number of compartments designed to give the most efficient

and even distribution of the steam to all of the surface of the condenser.

There are about 6000 1-in. tubes, making in all about 25,000 sq. ft. of surface. The circulating water makes two passes through the tubes, entering at one end and passing

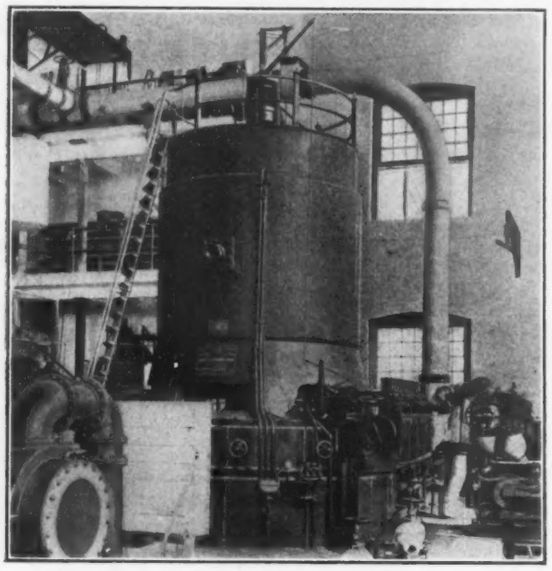


FIG. 3—LARGE HIGH-VACUUM CONDENSER

through the lower bank of tubes on both sides of the center, returning through the top bank to the discharge.

TESE OF DRY-VACUUM PUMP

Speed in r.p.m.	93.00
Steam cylinder:	
Mean effective pressure, lb.	33.76
Indicated horse-power.	73.10
Air cylinder:	
Mean effective pressure, lb.	5.37
Indicated horse-power	61.20
Mechanical efficiency, per cent.	83.89

The circulating water is drawn from Lake Michigan through an intake tunnel 150 ft. long and discharged to a

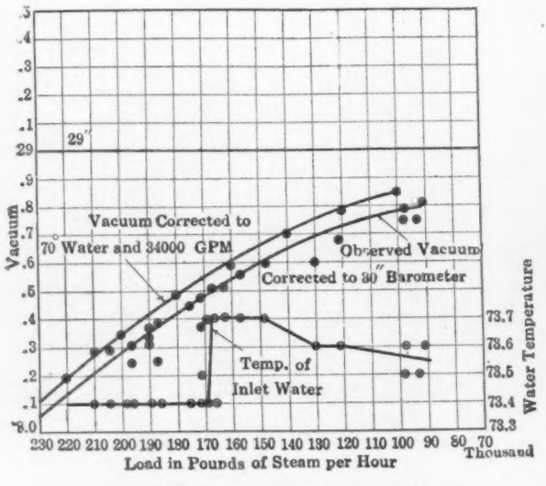


FIG. 4—RESULTS OF TEST ON CONDENSER

sewer. The circulating pump is a Wheeler 36-in. double-suction volute pump, operating at a speed of from 100 r.p.m. to 135 r.p.m., driven by a 20-in. by 24-in. Cooper Corliss engine. The performance of this pump is shown by curves in Fig. 2. The dry-air pump is a 14-in. by 36-in. by 24-in. Wheeler tandem rotative dry-vacuum pump. The efficiency of this pump is given in accompanying table, the figures being the average of twenty-four readings. It is to be noted that the mechanical efficiency of this pump is 89.89 per cent. Two 5-in. centrifugal hot-well pumps are installed, driven by 24-hp steam turbines.

The coefficients of heat transmission are calculated on the basis of 980 lb. Fahr. thermal units per pound of condensate and by the logarithmic formula for heat transmission.

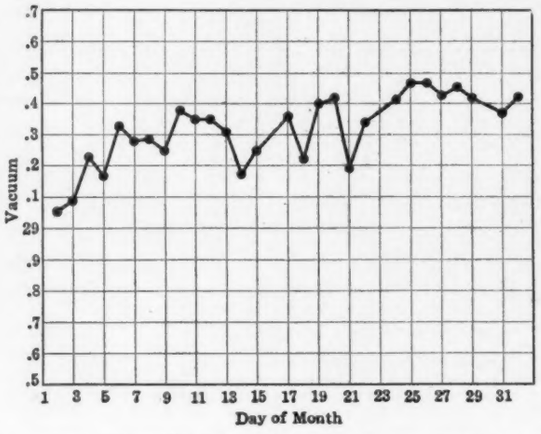
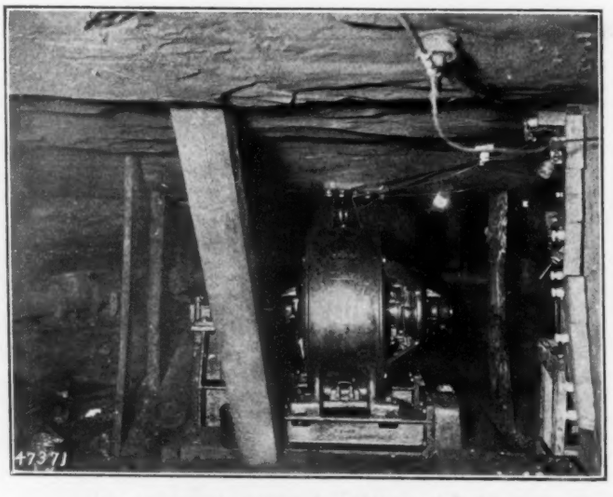


FIG. 5—ONE MONTH'S PERFORMANCE OF CONDENSER EQUIPMENT

A log of a month's performance of this condensing outfit is shown graphically in Fig. 5. This log covers performance in the month of January with inlet cooling water down to about 34 deg. Fahr. and shows a remarkable consistency in the operation of the condenser.

Self-Starting Direct-Current Motors

A new self-starting direct-current motor especially designed for driving mine pumps and fans has been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The only difference in construction between this motor and the type of motor



SELF-STARTING MOTOR INSTALLED IN A MINE

usually employed for these purposes is the heavier compounding winding, which reduces the starting current. This feature eliminates the necessity of starting boxes. It is claimed that the motors have been found highly satisfactory in service.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Washington Water Power's Year.—The report of the Washington Water Power Company, of Spokane, Wash., for the year ended Dec. 31, 1912, showed gross earnings of $3,170,245, as compared with $3,264,158 in 1911. Net earnings available for dividends were $1,075,545, as compared with $1,054,908. Dividends at the rate of 8 per cent per annum, amounting to $1,125,120, were paid, leaving a deficit for the year of $49,575. The surplus as of Dec. 31, 1912, was $1,136,466. The balance sheet as of Dec. 31, 1912, showed total assets and liabilities of $21,461,374. The electric light and power properties are placed at $12,309,232, the street-railway property, both city and interurban, at $4,357,410, and the real estate, buildings and water-power property at $3,675,568. There is $15,000,000 authorized capital stock, of which $14,081,900 is outstanding and $5,385,000 first-mortgage 5 per cent refunding bonds, due July 1, 1939. Up to Dec. 31 the company had spent $2,968,608 toward construction of its Long Lake development, from which no income has been received as yet. Excluding this unproductive amount from the outstanding capital stock of $14,081,900, the $11,113,291 capital representing the property actually in operation earned net $959,493, or 8.6 per cent. The receipts from the railway system in 1912 were less than in 1911, and a considerable part of the decrease is attributed to the increasing use of automobiles. The installed capacity of the company's power stations is as follows: Spokane, 12,000 hp; Post Falls, 15,000 hp; Little Falls, 27,000 hp, and the Spokane steam plant, 19,000 hp, making a total of 73,000 hp. The Long Lake development will have an initial installation of 33,000 hp and an ultimate installation of twice this figure, upon completion of which the total rating of the company's generating system will be 139,000 hp. The company also owns 25,000 undeveloped horse-power in Spokane. The work contemplated for 1913 includes continuation of construction of the Long Lake station, placing wires underground in Spokane, the erection of a warehouse in Spokane for the storage of materials, and extensions of the light and power system. The total output for 1912 was 140,216,201 kw-hr., an increase of 4.6 per cent over 1911. The connected load in motors in Spokane at the end of the year was 17,970 hp, comparing with 16,224 hp at the close of 1911, and the connected load in motors on the transmission lines for these two periods was 20,992 hp and 18,735 hp respectively. The number of accounts at the end of 1912 was 20,222, comparing with 19,105 in 1911, and the number of meters in use was 19,965, against 18,850 on Dec. 31, 1911. The company has under consideration the advisability of constructing a transmission line from Little Falls and Long Lake to Republic, Wash., about 110 miles in length, to serve the Republic and Chewelah mining districts and the towns of Chewelah, Colville and Republic and other smaller towns. The work at the Long Lake power development has proceeded most satisfactorily. The rock excavation for the main dam and power house was completed about Oct. 1, 1912, and shortly afterward the placing of concrete was begun. On Dec. 31 60,000 cu. yd. had been placed in the dam, bringing it up to an elevation 64 ft. above the lowest point of the bedrock; 163 ft. is still to be added, requiring about 215,000 cu. yd. more. The power-house foundation, containing 6800 cu. yd., has been finished and is now ready for the brick walls. The work of concreting will be continued during the winter, when the weather permits, and until the spring freshets overflow the dam; thereafter work should be resumed by July 10. The dam will probably be finished in time to fill the lake during the high water in the spring of 1914. Steps have been taken to acquire an additional right-of-way for the transmission lines from Long Lake to Spokane and a substation site adjoining the east city limits of Spokane, from which the Long Lake energy will be distributed when the generating plant is finished. Four separate transmission circuits, suspended from steel towers, will ultimately be erected on this right-of-way.

New Jersey's New Corporation Laws Considered Too Drastic.—What may be regarded as the first sign of the possible withdrawal of holding corporations from New Jersey as a result of the enactment of Governor Wilson's anti-trust bills by the Legislature of that State this week, occurred on Feb. 17, when the American Railways Company of Philadelphia, a New Jersey corporation which operates many street railway, electric lighting and steam-heating properties in various parts of the country, took out a charter in Delaware, with a capital of $25,000,000, to operate steam and electric railways wholly outside of Delaware. Since its incorporation in New Jersey in 1889, the American Railways Company has paid $54,522 to that State in taxes. Jeremiah J. Sullivan, president of the company, was quoted as saying that the New Jersey charter would probably be surrendered and that the company would transact its business hereafter under the laws of Delaware. In explanation of the company's move he is quoted as saying: "Under the new legislation it is made illegal for a holding corporation to loan money to a corporation outside the State or to buy additional properties. The American Railways Company operates numerous street railway properties in various states, and it is necessary to advance money to the companies from time to time and to finance their needs. We are constantly buying new properties. I do not think we could do business under the proposed laws. I think there is little doubt that many corporations will take similar action, and if so it will mean a considerable loss to the State of New Jersey." Whether or not an effect of the new laws will be to hasten the passage of a national incorporation act remains to be seen. Among the subsidiaries of the American Railways Company are the Altoona & Logan Valley Electric Railway Company; the Ashland (Ky.) Electric Light, Heat & Power Company; the Bridgeton (N. J.) Electric Company; the Bridgeton & Millville Traction Company; the Chicago & Desplaines Valley Electric Railway Company, Joliet, Ill.; Chicago & Joliet Railway Company; the Consolidated Light & Railway Company, Huntington, W. Va.; Home Electric Light & Steam Heating Company, Tyrone, Pa.; Ironton (Ohio) Electric Company; Johnstown (Pa.) Passenger Railway Company; Lynchburg (Va.) Traction & Light Company; Ohio Valley Electric Company, Huntington, W. Va.; People's Railway Company, Dayton, Ohio; Roanoke (Va.) Traction & Light Company; the Scranton (Pa.) Railway Company, and the Springfield (Ohio) Railway Company.

The Expansion of Central-Station Electric Service in Chicago.—In his annual report to the stockholders of the Commonwealth Edison Company of Chicago, made public on Feb. 14, President Samuel Insull made official statement of some interesting facts relating to the remarkable expansion of the company's business. In relation to the additions now under way at the Fisk Street generating station, he said: "The constantly increasing demand for the company's electric service has necessitated a large addition to the Fisk Street station, and this is now under construction. Eventually the capacity of that station will be doubled. With a view of installing in the additional building a turbo-generator of the highest efficiency, the lowest operating cost and the largest capacity, your directors, upon advice of Mr. Frederick Sargent, of Chicago, the company's consulting engineer, and Mr. Charles H. Merz, of London, England, consulting engineer, have contracted with Messrs. Charles A. Parsons & Company, of Newcastle, England, for a Parsons turbine and generator having a

maximum capacity of 35,000 electrical hp, the largest yet constructed. It is hoped that this will be in operation during the coming spring. Your directors have also contracted with the General Electric Company for a turbo-generator with a capacity of 27,000 electrical hp, and this will likewise be installed in the addition to the Fisk Street station. Upon the installation of these two units the company will have a total generating capacity of 400,000 electrical hp." During the year the company put into operation its new Northwest station, at Roscoe Street and California Avenue. Here there have been installed two turbo-generators, each having a rating of 27,000 electrical horse-power. In pursuance of its established policy of making such voluntary reductions in rates as found practicable, the company, by a series of reductions, was able to bring its net primary charge to 10 cents per kw-hr. on April 1, 1912, and its net secondary charge to 5 cents per kw-hr. on Oct. 1, 1912. To meet the company's growing requirements for office space it is expected that possession will be taken of the building now occupied by the Continental and Commercial National Bank, on the corner of West Adams Street and South Clark Street, after the removal of the bank to its new building in course of construction. The operating revenue of the company for the calendar year 1912 was $15,361,649. This compares with $13,902,266 for the year 1911. The operating expenses in 1912, including depreciation, were $8,855,572. Deducting also taxes and municipal compensation, which amounted to the sum of $1,127,194 for the year, the operating income was $5,378,882. Adding $203,347 of other income, the total net income was $5,582,229. From this was deducted $1,600,000 for interest on bonds and $544,000 as depreciation reserve under the requirements of the company's general mortgage. This left $3,438,229 as available for dividends. The sum of $2,516,784 was paid in dividends (at 7 per cent), leaving $921,445 as the balance carried to surplus. While there has been a large increase in the operating revenue, the amount carried to surplus has not increased in the same proportion. This is due to the rate reductions mentioned and to the increasing cost of labor and fuel. The total amount of capital stock outstanding at the close of 1912 was $37,764,140, and the total amount of outstanding bonds was $32,000,000. The balance sheet shows total assets of $80,908,052 on Dec. 31 last. The greater part of this, of course, is in plants, real estate, etc., but there is an item of $3,965,576 in cash. The total surplus on Dec. 31, 1912, was $5,252,146, and the depreciation reserve was $3,977,839.

Annual Report of the Public Service Company of Northern Illinois.—The annual report of President Samuel Insull of the Public Service Company of Northern Illinois covers a period of fourteen months ended Dec. 31, 1912. The territory served by this company is in the northeastern part of Illinois, surrounding Chicago. The company has acquired a number of public-utility properties, and its territory is divided into three general operating systems. The field served covers approximately 4300 sq. miles. The company has electric generating stations in Waukegan, Evanston, Maywood, Blue Island, Oak Park, Wilmington and Streator. In Joliet there are two generating stations, one steam and one hydroelectric, and in Kankakee similarly there are two generating stations. The company has thirty-two substations for the distribution of electricity and four gas generating plants. During the period covered by the report the company has effected a large reduction in the underlying obligations of the companies which it has acquired, the total of such retirement of debentures, bonds and water-fund certificates amounting to $6,729,000. The gross earnings for the fourteen months were $4,230,021, the net earnings being $1,861,567. Out of this were paid, or set aside, the following items: Bond interest, $745,734; depreciation reserve, $137,773; preferred-stock dividends (at 6 per cent), $311,349; common-stock dividends, $362,370. The balance carried to surplus was $304,530. The balance sheet shows that the liabilities include about $7,660,000 of preferred stock outstanding, about $9,065,500 of common stock outstanding, $8,800,000 of the Public Service Company's bonds in the hands of the public, and about $6,250,000 of underlying bonds and depreciation reserve. Reserves and surplus on Dec. 31, 1912, amounted to $543,056. The company's connected business (exclusive of railway power business) amounted to the equivalent of 1,468,606 standard 16-cp lamps on Dec. 31, 1912, being an increase of 262,332 during the fourteen-month period covered by the report. The annual meeting of the company will be held on Feb. 24, at 2:30 p. m. At that time the proposed consolidation with the Northwestern Gas Light & Coke Company will be voted upon.

Philadelphia Electric Company Declines Lease Offer.—Attention was called in these columns on Feb. 1, 1913, to the revival of the rumor that some form of consolidation would take place between the Philadelphia Electric Company and the United Gas Improvement Company, and that the latter would shortly make a proposal along these lines. Such a proposal was made last week by the United company. In general, the proposition was to lease the Philadelphia Electric Company for a term of ninety-nine years, on terms which would yield 8 per cent upon its paid-up capital stock of $17,500,000, provide for the refunding of the 4s and 5s and furnish funds for the extension and improvement of the property, without calling upon the stockholders of the electric company to make further payments upon the uncalled balance of subscription to its capital stock. The proposition was considered by the board of the Philadelphia Electric Company and after various conferences was declined.

Ohio Manufacturer Thinks Outlook Is Uncertain.—One of the best known manufacturers of power-station equipment in the State of Ohio, discussing trade conditions, said recently: "Our 1912 business was about the same in volume as that in 1911, and with a little better prices we made slightly better profits. These, however, are not satisfactory. While circumstances seem to point to more stability in prices, we regard the outlook for 1913 as dubious and uncertain. We think that the greatest drawback in our field is socialistic and labor agitation and unjust legislation against employers. Radical constitutional amendments in Ohio now threaten us with a commission government of almost unlimited power, such as the right to establish a minimum wage or the hours of labor per day, and various other enactments unjust to the employer. We can suggest no remedy, as our State is practically in the hands of socialism at the present time."

Mackay Companies Had Good Year.—At the annual meeting of the Mackay Companies in Boston on Feb. 15 it was voted to elect eight trustees to serve during the present year, as follows: Clarence H. Mackay, William W. Cook, George G. Ward, Edward C. Platt, Milton W. Blackmar, Henry V. Meredith, George Clapperton and Sir Edmund B. Osler. The last named three are additions to the board. In his report for the year ended Jan. 31, 1913, President Mackay says that the past year was one of constant progress with the Mackay Companies and with its land line and ocean systems. The income account shows income from investments in other companies of $4,136,009, as compared with $4,128,490 in 1911, and a balance, after operating expenses and preferred and common dividends, of $35,665, as compared with $27,379 in the year ended Jan. 31, 1912.

Crude-Oil Engine Manufacture.—In connection with the article on this subject in our issue of Feb. 8, our attention has been called to the extent of the pioneer work in this field carried out by the Busch-Sulzer Brothers-Diesel Engine Company of St. Louis. At the time of the expiration of the original Diesel patent last July, when oil-engine manufacture was in a degree thrown open to all, the Busch company had placed Diesel engines in operation in 117 individual plants. That number has now grown to 150, with a dozen more in various stages of installation. The aggregate horse-power of these plants is considerably more than 60,000.

Finds Dealers Optimistic on Washing-Machine Prospects.—Mr. R. C. Knopke, who was recently appointed sales manager for Ohio, Indiana and West Virginia by the Hurley Machine Company, manufacturers of the Thor electric home laundry machine, has returned from a trip through his territory, where he called upon the various dealers. All of them, he states, are very enthusiastic and look for a larger business in electric washing machines during the present year than ever before.

Decline in Copper Prices Continues.—Following a break in the price of copper in London last week, domestic selling agencies which have been holding out for 16¾ cents per pound for the past six weeks lowered their prices to 15½ cents per pound for electrolytic last Saturday for practically any delivery. In the early part of this week nearly all of the agencies quoted electrolytic on a 15-cent basis. Offerings were made on Tuesday by second hands at 14¾ cents per pound, and several of the largest agencies also reduced their quotations to that figure. This represents a falling off of 3 cents per pound from the quotation that was maintained by the selling agencies last summer. While domestic consumers have been buying to some extent during the break, their aggregate purchases have not been large enough to indicate that present prices are yet low enough to induce a movement of sufficient proportions to relieve the market. The extent of the present strain will undoubtedly depend upon the production figures in the next report of the Copper Producers' Association. If a noticeable decrease in output is shown it is probable that consumers will be satisfied to buy fairly large tonnages for future delivery at present prices. Otherwise they will feel safe in withholding commitments for the future until the trend of the market becomes more pronounced.

Southern Massachusetts Power Company Plan Abandoned.—As was noted in these columns April 20, 1912, the formation of a company to be known as the Southern Massachusetts Power Company was planned jointly last year by the Fall River (Mass.) Electric Light Company and the New Bedford (Mass.) Gas & Edison Light Company. It had been planned to make a large increase in the generating equipment of the Fall River company's plant and to furnish energy from this plant to both companies. A vigorous campaign for supplying central-station service to the many cotton mills in the territory was also planned. Owing, however, to the refusal of the New Bedford Board of Aldermen to pass an ordinance granting a franchise to the new company, the plan has been abandoned. Both the Fall River company and the New Bedford company are now going ahead to finance additions to their present generating equipment. The New Bedford company, it is understood, will spend about $400,000 and will install two horizontal turbines of 4000 kw each. The Fall River company will spent about $300,000 and will install one 4000-kw turbine.

National Quality Lamp's Arbitration Department.—At a recent meeting of the sales managers of the National Quality Lamp Division of General Electric Company, Mr. H. H. Cudmore, formerly manager of the Brilliant Electric Works of General Electric Company, was selected to serve as arbitrator in charge of the department of arbitration of the National Quality Division. The duties of the department of arbitration are connected with apportioning the spheres of activity of the various members of the lamp division and settling any territorial disputes that may arise. Mr. Cudmore's office will be at 30 Church Street, New York.

Keokuk Energy for Missouri Towns.—The Mississippi River Power Distributing Company of St. Louis has purchased the Tibbe Electric Company, of Washington, Mo., the American Light & Power Company, of Union, Mo., and the Pacific Electric Company, of Pacific, Mo. It is expected that all of these properties will be supplied with hydroelectric energy from the Mississippi River development at Keokuk, the generating plants being changed into substations. There is a day circuit and considerable industrial load at Washington, while the companies at Union and Pacific have street-lighting contracts.

National Carbon Changes.—D. D. Dickey has retired from the board of the National Carbon Company and has been succeeded by Andrew White. The report of the company for the year ended Dec. 31, 1912, shows net earnings of $1,261,203, against $931,145 in 1911. After preferred dividends of $315,000 there was a balance of $946,203 for the $5,500,000 common stock, which is equal to 17.2 per cent on that issue, as compared with 11.2 per cent earned on the same amount of stock in 1911. The surplus for the year, after deduction of common dividends and depreciation, was $250,110, as against $44,171 in 1911.

Automatic Telephone Service in Chicago.—Receivers for the Illinois Tunnel Company of Chicago, operating the underground freight tunnels and the automatic telephone system in that city, made their final report to the United States District Court on Feb. 7. The property is now under the management of a reorganization committee. The receivers report that the number of automatic telephones in connection with the system is now in excess of 25,000. Attention is also called to the growth and popularity of the tunnel method of transporting freight by means of narrow-gage electric railways forming a network beneath the streets in the central portion of Chicago.

H. W. Johns-Manville Salesmen's Annual Conventions.—Following a long-established custom, over 600 of the salesmen, together with the district managers, of the H. W. Johns-Manville Company assembled in annual convention on various dates from Jan. 2 to Feb. 8 at Milwaukee, Boston, New York, Philadelphia, Pittsburgh, Cleveland, Chicago, St. Louis, New Orleans, San Francisco and Toronto to learn more concerning the products sold by them. Each of the 300 or so of these products was discussed in detail and its merits were pointed out. A week's time was devoted to each of these conventions, with a banquet at the close.

To Merge Columbus Railway & Light Subsidiaries.—An application has been made to the Ohio Public Service Commission for authority to merge all the subsidiaries of the Columbus Railway & Light Company. The merger would include the Columbus Railway & Light Company, the Columbus Light, Heat & Power Company, the Columbus Edison Company and several underlying companies.

Will Supply Energy to Maryland Steel Company.—The Consolidated Gas, Electric Light & Power Company has entered into a contract with the Maryland Steel Company, Sparrow's Point, Md., to supply the latter with 6500 hp of electrical energy. It is stated that the central-station company is to supply 20,000 hp eventually to this concern.

Control of Ohio Company Changes Hands.—The Cleveland, Painesville & Eastern Railroad Company, Willoughby, Ohio, has purchased the United Light & Power Company, which furnishes electric service in a number of towns and rural sections in Lake and Ashtabula Counties, Ohio.

NEW YORK METAL MARKET PRICES

	Feb. 11		Feb. 18	
	Bid.	Asked.	Bid.	Asked.
Copper:				
Standard, spot	14.50	.....	14.00	.....
	£ s d		£ s d	
London, standard, spot	66 5 0		64 0 0	
Prime Lake	15.75 to 15.87½		15.00 to 15.12½	
Electrolytic	15.50 to 15.75		14.87½	
Casting	15.50		14.75	
Copper wire, base	17.50		16.25	
Lead	4.35		4.37½	
Nickel	40.00 to 45.00		40.00 to 45.00	
Sheet zinc, f.o.b. smelter	8.75		8.50	
Spelter, spot	49.12½		48.50	
Tin, spot	6.50		6.50	
Aluminum:				
Prompt delivery	25.50 to 26.00		26.50 to 26.00	
Future	25.50 to 26.00		26.50 to 26.00	

OLD METALS

Heavy copper and wire	14.25	13.37½
Brass, heavy	8.75	8.75
Brass, light	7.75	7.75
Lead, heavy	4.15	4.15
Zinc, scrap	5.75	5.37½

COPPER EXPORTS IN FEBRUARY

Total tons to Feb. 19	18,779

Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	Feb. 11	Feb. 19
Allis-Chalmers, t.r., 3d pd	$15,501,800	.....	.....	4	3⅜*
Allis-Chal., pf., t.r., 3d pd	14,105,500	.....	.....	10	10*
Amalgamated Copper	153,887,900	1½	Q	71½	67½
American Tel. & Tel	334,887,700	2	Q	132	132½
Electric Storage Battery, c.	16,074,425	1	Q	53	51½
General Electric	101,203,500	2	Q	140½	139
Mackay Cos., c.	41,380,400	1½	Q	84*	86½*
Mackay Cos., pf.	50,000,000	1	Q	67*	67½
Western Union Tel.	99,745,400	¾	Q	72	68½
Westinghouse, E. & M., c.	33,821,200	1	Q	71⅜	70
Westinghouse, E. & M., pf.	3,998,700	1½	Q	119½*	117*

*Last price quoted.

Personal

Mr. G. H. Smart has succeeded Mr. J. H. Drake as superintendent of the electrical department of the Knoxville (Tenn.) Railway & Light Company.

Mr. H. C. Gamage has been appointed superintendent of the Ware County Light & Power Company, Waycross, Ga., succeeding Mr. J. W. Reeve, resigned.

Mr. M. Metz has resigned his position as manager for the Harlan & Avoca Telephone Company at Oakland, Ia., to accept a position with the Oakland Electric Company.

Mr. J. W. Kirkland, vice-president of the South African General Electric Company, has been elected president of the South African Institute of Electrical Engineers for the current year.

Mr. George N. Rooker, general manager of the Northern Idaho & Montana Power Company, Sandpoint, Idaho, has been appointed a member of the public improvement committee of the Sandpoint Commercial Club.

Mr. P. C. Kaercher, who has been purchasing agent of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, has been promoted to the power sales department as assistant to Mr. T. L. Sturgeon.

Mr. J. Wright Reeve has resigned from the position of superintendent of the Ware County Light & Power Company's properties, at Waycross, Ga., and will enter into the sales department of one of the leading electric manufacturers.

Mr. A. A. Dion, manager of the Ottawa Electric Company, Ottawa, Ont., delivered an interesting lecture on "Electrical Underground Conduit Construction" before the Ottawa branch of the Canadian Society of Civil Engineers on Feb. 7.

Dr. Edward P. Hyde, director of the research laboratory of the National Electric Lamp Association, delivered a lecture Feb. 10 before the engineering students of the University of Virginia, the subject being "Illuminating Engineering, Its Evolution and Its Goal."

Mr. W. H. Atkins, general manager, and Mr. W. P. Hancock, superintendent of generation of the Edison Electric Illuminating Company of Boston, sailed from New York on the Cunard Line steamship *Laconia* on Feb. 15 for a three months' trip to Egypt and Mediterranean points.

Mr. J. E. Aldred, president of the Shawinigan Water & Power Company of Shawinigan Falls, Quebec, has presented the town of Shawinigan Falls with a technical school built at a cost of $50,000. The structure is of brick and has a good equipment of electrical and other technical apparatus.

Mr. William McClellan, chief engineer of the Public Service Commission, Second District, New York, gave a talk at the Technology Union, Boston, on Feb. 12, before the Electrical Engineering Society of the Massachusetts Institute of Technology, his subject being "Public Service Corporations and the Public."

Mr. Alexander D. Dubois, assistant professor of electrical engineering at Purdue University, has resigned because of ill health. Mr. Dubois went to Purdue from Cornell University two years ago. He is a graduate of Illinois University. For nine years previous to entering Cornell he was employed by the Western Electric Company.

Messrs. Frank E. Shepard, of the Denver Engineering Works, and A. B. Kennedy, of the Stearns-Rogers Machinery & Supply Company, both of Denver, have been elected directors of the Colorado Electric Club, succeeding Messrs. J. F. Dostal and J. W. Greenawalt, who recently resigned on account of removal from Denver.

Mr. A. A. Laughton has been appointed local manager of the Athol (Mass.) Gas & Electric Company. Mr. Laughton is now employed as local manager of the Gardner (Mass.) Gas, Fuel & Light Company, which position he will continue to fill in addition to his new duties at Athol. He will make his headquarters, however, in Athol.

Dr. Ernst J. Berg, for the last four years head of the electrical department of the University of Illinois, has been appointed professor in charge of the electrical department of Union College, Schenectady, N. Y. Dr. Berg is a native of Sweden and was educated in the Royal University of Stockholm. For many years he was connected with the General Electric Company, where he worked as assistant to Dr. Steinmetz.

Mr. Charles B. Scott has been made manager of the new Bureau of Safety operated in conjunction with the Middle West Utilities Company of Chicago. This bureau advises subsidiary companies on questions relating to safe operation, claims and indemnities. For several years Mr. Scott has been associated with Mr. Martin J. Insull, vice-president of the Middle West Utilities Company, in the operation of public utilities in Indiana and elsewhere.

Mr. Alfred Still has resigned his position as chief electrical engineer to the Algoma Steel Corporation of Sault Ste. Marie, Ont., to take charge of the courses in electrical design at Purdue University, Lafayette, Ind. Mr. Still is a member of both the American Institute and British Institution of Electrical Engineers. He has made a special study of hydroelectric developments and long-distance transmission of electrical energy, and has only lately returned from a trip to Colorado and the Pacific Coast, where he visited many of the important systems of power transmission and distribution.

Mr. Robert M. Searle, the well-known vice-president of the Rochester (N. Y.) Railway & Light Company, whose election as president of the Rochester Chamber of Commerce was announced in these columns a short time ago, was born March 3, 1869, at Peekskill, N. Y. He received a common-school education in the public schools of the city of New York and in 1884 began in the lighting business as office boy with Thomas A. Edison. Mr. Searle acquired his engineering knowledge by night study, and he has had twenty-six years of experience in the lighting business in all of its varied branches—from office boy to vice-president. He was awarded the honor medal by the English Institute of Gas Engineers in 1907. At present Mr. Searle is actively engaged on committees in about forty-four institutions within and without the State of New York. He is vice-president and a director of the Rochester Railway & Light Company, a director of the New York State Railways, and, as previously announced, was elected to the presidency of the Rochester Chamber of Commerce in January.

ROBERT M. SEARLE

Obituary

Gustaf de Laval, the well-known engineer and inventor of the steam turbine bearing his name, died at his home in Stockholm, Sweden, on Feb. 7 at the age of sixty-seven. Dr. de Laval after devoting much time to the design of dairy machinery, turned his attention to the construction of a high-speed rotary engine in 1883. He patented his divergent-nozzle steam turbine in 1889.

Edward L. Clark, for many years auditor of the General Electric Company, died at his home in Schenectady, N. Y., Feb. 15. Mr. Clark was born in Edinburgh, Scotland, in 1849 and came to America and was employed by Mr. Edison as auditor of the Edison Electric Light Company in New York City. In December, 1891, he became auditor of the Edison General Electric Company, and he had full charge of the arduous work of consolidation of accounts when the General Electric Company was organized in 1892. Two years later Mr. Clark was made assistant to the comptroller, the late J. P. Ord, and soon thereafter was made general auditor of the company and continued in that capacity until his death. He is survived by a widow and two sons.

Construction

ALABAMA CITY, ALA.—The City Council has granted the Alabama Pwr. Co., of Gadsden, a francise to erect transmission lines in Alabama City.

BESSEMER, ALA.—The J. B. McCrary Co., of Atlanta, Ga., has been engaged by the City Council to make surveys and estimates for construction of the proposed municipal electric-light plant, for which bonds to the amount of $35,000 have been authorized.

FOREMAN, ARK.—An electric-light franchise has been granted to W. B. and J. M. Madden.

BAY CITY, CAL.—The Pacific El. Ry. Co. has applied to the County Supervisors for a franchise to build and operate an electric railway on Main Street and Ocean Avenue in Bay City.

CHICO, CAL.—Plans are being considered by the management of Richardson Springs for the establishment of an electric light and power plant, to cost about $10,000. The water-power of Mud Creek will be utilized to operate the proposed plant.

FRESNO, CAL.—The San Joaquin Lt. & Pwr. Co. will soon begin work on construction of its power plant No. 4, to be located on the east side of Crane Valley Lake, where a fall of 2000 ft. will be secured. Two tunnels will be driven to divert the water, one of which will be about a mile long. Water will be secured from Sand Creek and the South Fork. Two reservoirs will be constructed to supply Plant No. 4, one of which will be located on Sand Creek and the other on the South Fork.

LOS ANGELES, CAL.—Bids will be received by the Board of Public Works until March 7 for furnishing miscellaneous electrical material, consisting of lead-covered cable and terminals, copper tubing and fittings, bus supports and disconnecting switches.

MONROVIA, CAL.—The city authorities are contemplating the installation of a new police and fire-alarm system.

OWENSMOUTH, CAL.—Plans are being prepared for lighting the streets of Owensmouth and the 18-mile speedway to Lankersham also. The Southern California Edison Co. is planning to erect a new substation to supply electricity for lamps in this district. Owensmouth has not a post office.

REDWOOD CITY, CAL.—Bonds to the amount of $6,000 have been voted, the proceeds to be used for extension to street-lighting system.

SAN FRANCISCO, CAL.—The Marconi Wireless Co. has officially announced that one of the five large wireless stations which the company has been planning will be erected at Tanalas Bay and Bolinas. It is proposed to install a 1000-hp plant at each of the stations.

SAN FRANCISCO, CAL.—Property owners on Ninth Street have secured authority from the lighting committee to erect a tungsten lamp street-lighting system, using six standards to the block. Arrangements have been made for the installation of cluster lamps on Mason Street. The property owners will erect the electroliers, carrying five-lamp clusters; the city will supply electricity to maintain them.

NORWICH, CONN.—The Connecticut Co. proposes to furnish energy for the New London electric railways from the Thamesville station, using the station at Winthrop's Cove for a transforming station. If necessary to carry the New London load, additional equipment will be installed at Thamesville. The company has petitioned the Public Service Commissioners for permission to connect the Thamesville and New London stations.

WINDSOR LOCKS, CONN.—Plans have been nearly completed by the Northern Connecticut Lt. & Pwr. Co., of Windsor Locks, for the erection of the new transmission line and substation to supply the towns formerly served by the Housatonic Pwr. Co., Suffield, Agawam and Feeding Hills, and work will probably be started in the spring. Walter P. Schwabe is general manager.

WASHINGTON, D. C.—Proposals will be received at the office of the chief signal officer, War Department, Washington, D. C., until March 1 for the following supplies: (1) 500 telephone head sets; (2) 150 ear caps for Dean hand receivers; (3) 200 retardation coils; (4) 72 porous cups; (5) 125 diaphragms; (6) 100 condensers; (7) 36 rubber gaskets for door of B. C. telephones; (8) 36 rubber gaskets for door of gun telephones; (9) 12 iron handles, complete, for B. C. telephones, C. A. T.; (10) 12 iron handles, complete, for gun telephones; (11) 75 universal joints for C. A. T. head sets; (12) 12 transmitters, suspended type, complete, consisting of transmitter bar, brackets for same, two h. r. bushings, C. B. transmitter, cords and weights; (13) 100 shells for Dean hand receivers without caps; (14) 200 rings for Dean hand receiver. Captain W. L. Clarke is disbursing officer.

GAINESVILLE, FLA.—Proposals will be received by the Board of Public Works, Gainesville, Fla., at the offices of H. E. Taylor, chairman, until March 17, for furnishing all material, machinery, equipment and labor for the construction of an electric-lighting system and improvements to the water-works system. The work will embrace a complete water-works and lighting station erected in the town on the railroad, approximately 20 miles of pole line, 4300 ft. of 14-in. cast-iron pipe, one 150,000-gal. tank on 75-ft. tower. Station equipment will consist of three 150-hp return-tubular boilers, one 600-hp steel or reinforced-concrete stack, one 600-hp feed-water heater and purifier, one 1,500,000-gal. high-duty Meyer gear or triple-expansion pump, one cross-compound condensing compressor, 750 cu. ft. capacity, or one motor-driven deep-well centrifugal, one 300-gal. motor-driven centrifugal pump, one 250-kw and one 150-kw generator, direct-connected to four-valve non-condensing Corliss or compound non-condensing engines, with switchboards and exciters. Specifications may be obtained from the J. B. McCrary Co., engineers, Third National Bank Building, Atlanta, Ga., or from the chairman of Board of Public Works.

ST. CLOUD, FLA.—The St. Cloud Public Utilities Co. has been granted a franchise by the City Council to construct an electric-light system here.

ST. PETERSBURG, FLA.—Plans are being prepared by the St. Petersburg El. Lt. & Pwr. Co. for the erection of a new power plant, to cost from $100,000 to $150,000. The proposed plant will be equipped with two 1200-kw generating units. Definite plans have not yet been decided upon.

AUGUSTA, GA.—Sealed proposals will be received by George W. Wright, chairman hospital building committee, re-inclosed in an envelope addressed to William Lyon Martin, clerk of Council, Augusta, Ga., until Feb. 27 for specialties for the city hospital buildings as follows: Item (11) painting; (12) plumbing, roughing in; (13) vacuum-cleaning piping; (14) gas fitting; (15) electric work, wiring and signal system; (16) telephones; (17) elevators; (18) vacuum-cleaning machine; (19) vacuum-cleaning aspirator; (20) fire hose; (21) boiler plant; (22) chimney; (23) engines; (24) generators and switchboards; (25) heating; (26) plumbing fixtures. Plans and specifications may be obtained on application to G. Lloyd Preacher, of Augusta, architect and engineer. L. C. Hayne is Mayor.

GRIFFIN, GA.—An appropriation of $5,000 has been authorized by the City Council for extensions to the electric-light and water-works systems.

MALAD, IDAHO.—D. L. Evans, of Malad, has purchased the property of the Idaho Lt. & Pwr. Co. for $35,000. The new owner contemplates making improvements to the plant.

CERRO GORDO, ILL.—The Central Illinois Pub. Ser. Co. has submitted a proposition to the Village Board to supply electricity to operate the municipal water-works pumping station.

DECATUR, ILL.—The People's Co-operative Lt. Co., of Decatur, which recently applied for a franchise to construct an electric light and power plant here, expects to increase its capital stock from $50,000 to $100,000 in the near future. If granted a franchise the company will erect a plant in Decatur. Frank L. Suffern is president and treasurer.

DEER CREEK, ILL.—The Peoria Gas & El. Co. is seeking a contract to light the streets of the village. If successful, it will supply electricity for lamps and motors for commercial purposes.

HIGHLAND, ILL.—The Illinois Trac. System, of Champaign, is seeking a franchise to furnish electricity for lamps and motors here; also a contract to light the streets of the village.

JACKSONVILLE, ILL.—The City Council is considering an ordinance providing for an issue of $50,000 in bonds for the rehabilitation of the municipal electric-light plant.

LOCKPORT, ILL.—Two propositions have been submitted to the City Council for furnishing electricity to the city. The Public Ser. Co. of Northern Illinois asks for a 50-year franchise and a ten-year contract for street lighting, in return for which it offers to pay the city $5,000 and to rebuild the city lines throughout, changing the system to 110 volts. A maximum rate of 2½ cents per kw-hr. with a probable rate of 2 cents is offered for energy to operate the water-works pumping station. Private consumers are offered a rate of 13½ cents and 7 cents per kw-hr. and business houses 9 cents per kw-hr. It also agrees to rewire residences for flatirons and other appliances from 220 volts to 110 volts without charge. The company will furnish a street-lighting system consisting of 75 tungsten lamps and 15 four-lamp clusters, with all-night service, at $2,460 per year on a ten-year contract. The Sanitary District of Chicago asks for a five-year contract at 1 cent per kw-hr., arc lamps to be furnished by the company but to be maintained by the city, and tungsten lamps to be furnished by the city and maintained by the company. The entire city and commercial circuits are to be rebuilt by the Sanitary District, which will retain the discarded material. At the end of the five-year contract the city will own the rebuilt lines. The voltage is to be reduced from 220 volts to 110 volts.

OAK PARK, ILL.—The Village Board has agreed to maintain the ornamental street-lighting system in the business district, provided the Business Men's Association will pay for the cost of installing the system. It is understood that funds have already been subscribed for the standards.

PITTSFIELD, ILL.—The proposition to grant the Central Illinois Pub. Ser. Co., of Mattoon, Ill., a 50-year franchise to operate an electric-light plant in Pittsfield will probably be submitted to the voters at the spring election.

BATTLE GROUND, IND.—The County Commissioners have granted the Mutual Pub. Ser. Co. permission to erect a transmission line from Battle Ground to the White County line. The company will secure energy from the Fort Wayne & Northern Indiana Trac. Co., which it will distribute for lamps and motors in Battle Ground, Brookston and Chalmers and also to farmers residing along the route of the transmission line.

BROAD RIPPLE, IND.—The Town Board has signed a contract with the Merchants' Ht. & Lt. Co., of Indianapolis, for lighting the streets of the town. The board canceled the contract with the Indianapolis Lt. & Ht. Co. recently.

CENTERVILLE, IND.—The Town Council has awarded the Terre Haute, Indianapolis & Eastern Trac. Co. a contract to furnish electricity for lighting the streets of the town and for commercial purposes.

EVANSVILLE, IND.—The West Side Business Men's Association is heading a movement to organize a public service company, to be capitalized at $100,000, to erect and operate an electric light and power plant in Evansville.

INDIANAPOLIS, IND.—The plant of the People's Lt. & Ht. Co., of Indianapolis, is to be consolidated with that of the Merchants' Ht. & Lt. Co., of this city. Energy and heat will be supplied from the station of the Merchants' Ht. & Lt. Co., which is to be rebuilt. Tentative plans provide for a 10,000-kw generator.

KENDALLVILLE, IND.—Bids will be received for the construction of a new power house for the municipal electric-light plant until March 11. The cost of the building is estimated at about $10,000. Contracts for equipment have already been placed.

McCORDSVILLE, IND.—The Indiana Union Trac. Co. has entered into a contract with the town board of McCordsville Kennard, Sharpsville and Hobbs to supply electricity for lamps and motors.

ROCHESTER, IND.—The Rochester Lt., Ht. & Pwr. Co. has increased its capital stock from $150,000 to $200,000.

AMES, IA.—At a special election held Feb. 10 the proposition to issue bonds to establish a municipal electric-light plant was carried.

BAYARD, IA.—The citizens are considering the question of establishing an electric-light plant here.

DENISON, IA.—The Denison El. Lt. & Pwr. Co. contemplates improvements to its plant which will involve an expenditure of about $20,000 in the next two years.

FONTANELLE, IA.—The City Council is considering the question of installing an electric-light plant. It is estimated that a plant can be installed at a cost of about $7,500.

GREENFIELD, IA.—Preparations are being made to change the municipal electric-light plant from direct-current to alternating-current system and to establish a 24-hour service. The equipment will include one engine and two alternating-current generators and switchboard equipment complete, transformers, overhead-line materials, meters, etc. J. B. Hill, of Iowa City, is consulting engineer.

LEON, IA.—The city of Leon is not contemplating the construction of a municipal electric-light plant as reported in these columns some time ago. The railroad company will build a new freight depot on the site said to have been purchased by the city. The Leon El. Co. furnishes electrical service in Leon and the city does not contemplate taking over the plant.

PERRY, IA.—The question of submitting a proposition to raise funds for rebuilding the electric-light system at the spring election is under consideration.

REDFIELD, IA.—The town of Redfield, it is reported, will receive bids about March 1 for construction of combined electric-light and water works systems; also for each system separate.

RUSSELL, IA.—A proposition has been submitted to the town of Russell for the installation of an electric-light plant by J. D. Elder, of Albia.

TOPEKA, KAN.—The purchase of a new generator, to cost about $3,000, to be installed in the municipal electric-light plant before next fall is under consideration.

BURNSIDE, KY.—The Kentucky Utilities Co., of Lexington, has been granted a 20-year franchise to supply electricity in Burnside. Harry Reid, of Lexington, is general manager.

EMINENCE, KY.—The Kentucky Utilities Co., of Lexington, has purchased several franchises recently, allowing the company to enter Eminence, Pleasureville and New Castle, Ky., as well as in the counties in which those cities are located. Work will soon begin on extensions to the company's present lines.

HENDERSON, KY.—The Kentucky Southwestern El. Ry., Lt. & Pwr. Co. contemplates the construction of three substations. W. A. Calhoun, of Paducah, is chief engineer.

HOPKINSVILLE, KY.—The Kentucky Pub. Ser. Co., of Hopkinsville, is contemplating extensions and improvements to its plant and will install one 500-kw, three-phase, 60-cycle generator directly connected to steam turbine; new switchboard, etc. All lines are to be changed from two-phase to three-phase and present generators are to be wound for three-phase and held as a reserve. J. G. White & Co., 43 Exchange Place, New York, N. Y., are engineers in charge.

LEXINGTON, KY.—The installation of an ornamental street-lighting system along the principal business throughfares is contemplated. It is proposed to erect ornamental lamp standards carrying five-lamp standards. Eugene Creed, busines manager of the Lexington Utilities Co., has charge of the work.

OWINGSVILLE, KY.—The Kentucky Utilities Co., of Lexington, is negotiating for the purchase of the plant of the Owingsville El. Lt. Co. If acquired the plant will be remodeled.

PADUCAH, KY.—The Paducah Lt. & Pwr. Co. is negotiating with the City Council for furnishing energy at a cost of $2,100 per year, for a new street-lighting system in the retail business district.

WINFIELD, LA.—George W. Newman, of Rochester, N. Y., has purchased the controlling interest in the Winfield Ice & Lt. Co. It is proposed to rebuild both the ice and electric plants and install new machinery. Mr. Newman will be president and manager of the company.

PORTLAND, MAINE.—The Cumberland County Pwr. & Lt. Co., of Portland, contemplates the erection of a new transmission line from Bonny Eagle to North Gorham, for which the right-of-way has already been purchased. The cost of the line is estimated at about $100,000.

ELLERSLIE, MD.—The Cooks Mills El. Lt. & Pwr. Co., controlled by Deal Brothers, of Cumberland, represented by J. W. S. Cochrane, attorney, has applied to the Road Commissioners of Allegany County for a franchise to erect transmission lines from the state line to Corrigansville for the purpose of supplying electricity for lamps, heat and motors in Corrigansville and Ellerslie.

ELLERSLIE, MD.—Application has been made to the Road Commissioners of Allegany County for a franchise to erect transmission lines along the county road for the purpose of supplying electricity by Andrew Ramsay, representing the Ramsay Corporation, which has large brick plants at Mount Savage and Ellerslie. The company proposes to erect a water and light plant, at a cost of $250,000, to supply the two plants with water and electricity, and to furnish electricity for lamps in Ellerslie.

BOSTON, MASS.—The Massachusetts El. Cos. will spend $1,500,000 for new construction and betterments to its properties during the current year. Of this amount $1,000,000 will be for new work.

FALL RIVER, MASS.—The Merchants' Association has submitted a proposition to the City Council offering to pay $2,000 per year for a period of five years toward maintaining the proposed ornamental street-lighting system in the business district.

MARLBORO, MASS.—The Marlboro El. Co. has applied to the State Board of Gas and Electric Light Commissioners for permission to issue 1300 additional shares of capital stock at $160, the proceeds to be used in financing additions to and improvements in the company's plant.

MONROE BRIDGE, MASS.—The New England Pwr. Co. which is building a series of hydroelectric plants on the Deerfield River, has filed a petition with the County Commissioners asking for approval of plans for the construction of a dam on the Deerfield River about ¼ mile below Monroe Bridge in the town of Monroe. The proposed dam is to be 253 ft. long.

NEW BEDFORD, MASS.—Extensive improvements and additions are contemplated by the New Bedford Gas & Edison Lt. Co. to its plant. The plans provide for new buildings and reconstruction of present buildings and installation of new machinery, including two 4000-kw turbines, orders for which have already been placed. Oliver Prescott is president.

WEST BROOKFIELD, MASS.—The question of lighting the streets of West Brookfield is under consideration. A proposition has been submitted by the Central Massachusetts El. Co., of Palmer, which has a franchise here. One plan provides for 56 lamps to burn until 1 o'clock every night at $17.50 each per year, the other for lamps to burn until 12 o'clock at $15.50 per lamp per year.

WORCESTER, MASS.—Plans are being prepared by the Worcester El. Lt. Co. for the installation of another 5000-kw turbine, additional boilers and machinery at the Webster Street station, and for extension of coal-storage bins and other improvements, involving an expenditure of about $250,000. The company, it is said, is now receiving bids for the turbine, condensers, etc., and two additional boilers, which will provide for 1500 hp. Extension of cables, etc., will also be made.

BATTLE CREEK, MICH.—Two centrifugal pumps will be installed at the pumping station which is to be erected at a cost of $40,000, to be driven by electric motors, one of 100 hp and the other of 200 hp.

BELDING, MICH.—The Spencer El. Lt. & Pwr. Co., of Belding, Mich., expects to purchase a 250-hp engine and boilers and necessary accessories for steam plant and one waterwheel governor within the next ten months. J. E. Stanton is manager.

BUCHANAN, MICH.—The Buchanan El. Steel Co. is preparing to install a new 5-ton electric furnace. W. N. Broderick has been appointed assistant superintendent.

DETROIT, MICH.—The State Railroad Commission has authorized the Eastern Michigan Edison Co., of Detroit, to sell $865,000 in bonds, the proceeds to be used for the purpose of making extensions and improvements.

DETROIT, MICH.—The annual report of the Detroit Edison Co. announces that a fourth turbo-generator has been purchased for the Delray power plant, to be delivered during the coming summer. The new generator will be installed in the No. 2 power house. Announcement is also made that a new power plant is to be constructed on the east side of the city, 8 miles up the stream from the Delray plant, a site for which has already been purchased at a cost of $50,000. Alexander Dow is vice-president and general manager.

FENTON, MICH.—A proposition to install a municipal electric-light plant at a cost of $25,000 and to issue bonds for same will be submitted to the taxpayers at the next regular corporation election, which takes place next March. Electrical service is now furnished by the Independent Lt. & Pwr. Co.

GLADSTONE, MICH.—Negotiations are pending for the installation of electric motors in the Soo Line elevator and warehouses to operate the machinery, to replace the steam plants. If the change is made, energy

would be furnished from the power station of the Escanaba Trac. Co., on the Escanaba River. C. H. Bayliss is chief engineer of the Soo Line.

GRAND RAPIDS, MICH.—The City Council has approved the recommendation presented by the ways and means committee advising the purchase of a 550-kw turbo-generator set for the municipal electric-light plant, at a cost of $30,000.

PINCKNEY, MICH.—The local electric-light plant, owned by Floyd Jackson, has been sold to Richard Clinton.

ELYSIAN, MINN.—The Consumers' Pwr. Co. contemplates extending its lines throughout the city, for which a franchise will soon be asked.

MINNEAPOLIS, MINN.—The Franklin Avenue Business Men's Association is considering the installation of ornamental street lamps on Franklin Avenue from Tenth Avenue south to Cedar Avenue.

MORRIS, MINN.—The Otter Tail Pwr. Co., of Fergus Falls, has been granted a franchise to supply electricity here. The company proposes to erect a transmission line from Dayton Hollow to Morris, via Wendell, Donnelly and Herman. The steam plant at Morris will be rebuilt and held for use in emergencies. An option has already been secured on the Morris plant. Both the Morris and Wahpeton transmission lines will be connected with the Dayton Hollow and Hoot Lake power plants.

WARROAD, MINN.—At an election held Feb. 7 the proposition to issue $20,000 for electric-light plant, town hall and jail and $8,000 for water-works was carried. The Oscar Claussen Engineering Co., of St. Paul, Minn., has charge of the work. E. M. Heimbach is village clerk.

WYOMING, MINN.—The village of Wyoming is considering the question of installing an electric-light system.

FRANKFORD, MO.—The L. T. Tucker Co. has been granted a franchise to supply electricity here. An electric plant will be installed in connection with its flour mill. The company would like to receive estimates on a 40-kw or 50-kw three-phase, 2300-volt alternator.

HANNIBAL, MO.—The North Missouri Pwr. Co. is planning to erect 65 miles of 33,000-volt transmission line. Plans have not yet been definitely decided upon. The company is associated with the municipal Public Ser. Co., 1105 Chemical Building, St. Louis, Mo. Morrison & McCall, 1105 Chemical Building, St. Louis, engineers, have charge of the work.

POPLAR, MONT.—An effort is being made to organize a stock company to construct and operate an electric-light plant in Poplar. The cost of the proposed plant is estimated at $3,000.

LINCOLN, NEB.—The city clerk has been instructed to advertise for a car unloader, elevator and motor for the water and light plant.

PORTSMOUTH, N. H.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 8, for one 20-ton, four-motor electric traveling crane, delivered at the navy yard, Portsmouth, N. H. The cost of the work is estimated at $5,000. Specifications can be obtained on application to the bureau or the commandant of the navy yard named. H. R. Stanford is chief of bureau.

BORDENTOWN, N. J.—The Board of Public Utility Commissioners has granted the Bordentown El. Co. permission to issue $50,000 in additional stock, the proceeds to be used for extensions and improvements to its plant.

HIGHTSTOWN, N. J.—The Borough Council has made arrangements with the Electric Lt. & Pwr. Co. of Hightstown for the installation of a new tungsten street-lighting system to replace the arc lamps now in use.

JERSEY CITY, N. J.—Prof. A. F. Ganz, Stevens Institute of Technology, Hoboken, has been engaged to make investigations of the electric-light plants in the court house and at Snake Hill and prepare estimates of cost of equipping the plants to furnish electricity for lighting the county parks, roads and institutions.

JERSEY CITY, N. J.—Owing to the refusal of the Public Service Electric Co. to bid upon the lighting specifications advertised by the Street and Water Board, the commissioners are considering the project of establishing a municipal electric-light plant at the City Hospital grounds, where three large dynamos are installed although only one is being used. Another generator could be installed with the present engines, which would enable the plant to furnish electricity to light a large portion of the city. It is suggested that the electric plant at the high-service station could also be utilized to light a large section of the city.

KEYPORT, N. J.—The Board of Public Utility Commissioners has granted the Middlesex & Monmouth El. Lt., Ht. & Pwr. Co. permission to erect new transmission lines on the turnpike between Freehold and Matawan.

PENNS GROVE, N. J.—The Penns Grove El. Lt., Ht. & Pwr. Co. has awarded the contract for erection of buildings and also for an ice plant, work on which will begin at once. The borough will be lighted by the new company. The officers are: Matthew Mitchell, president; Harry A. Dolbow, treasurer, and S. Rusling Leap, secretary.

ALBANY, N. Y.—Contracts have been awarded for erecting power stations and installing electrical machinery for operating and lighting locks along the Erie and Champlain Canals to McArthur Brothers Co. and the Lord Electric Co., of New York, N. Y., for $1,612,356.

BAYSHORE, N. Y.—The United States Wave Pwr. Co. has decided to establish a large power plant at Saltaire. The proposed plant will furnish electricity for Saltaire and adjacent developments.

BINGHAMTON, N. Y.—The proposition to issue $43,000 in bonds for the purpose of installing underground conduits and boulevard lamps in Court Street from Exchange to Carroll, and in Chenango from Court Street to the viaduct, will be submitted to the taxpayers. An election will probably be held March 21.

COHOES, N. Y.—Sanderson & Porter, 52 William Street, New York, N. Y., consulting engineers, have been engaged by the Cohoes Pwr. Co. to take charge of construction of its proposed hydroelectric power plant. W. P. Parsons, of Cohoes, is superintendent.

NEW YORK, N. Y.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 17, for a non-interfering local fire-alarm system at the United States appraisers' warehouse, New York, N. Y., in accordance with specifications, copies of which may be obtained from the supervising chief engineer, New York, N. Y., or at the above office. O. Wenderoth is supervising architect.

POTSDAM, N. Y.—The Northern Pwr. Co. of Potsdam has applied to the Public Service Commission, Second District, for permission to exercise its franchises to erect transmission lines and supply electricity in the village and town of Antwerp and the town of Rossie.

BURLINGTON, N. C.—The City Council has decided to call an election to vote on the proposition to sell the municipal electric-light plant submitted by E. S. Parker, Jr., representing the company which proposes to purchase the plant. The company offers to purchase the plant at $50,000, the city to retain all real estate and machinery now owned by it, the city to pay $60 per year for each arc lamp.

DURHAM, N. C.—Z. V. Taylor, representing the Southern Pwr. Co., of Charlotte, has asked the City Council to delay the awarding of the street-lighting contract for two weeks to allow his company to submit a proposition for street lighting. The service is now supplied by the Durham Trac. Co.

JAMESTOWN, N. D.—The City Council is considering a proposition to install an electric-light plant.

MOHALL, N. D.—The installation of an electric-light plant in Mohall is under consideration.

MOTT, N. D.—Propositions for the installation of an electric-light plant in Mott have been submitted by outside parties.

PEMBINA, N. D.—The city of Pembina is considering the question of purchasing the plant of the Pembina Ltg. Co.

DAYTON, OHIO.—Proposals will be received at the office of the supervising officer, Treasury Department, Washington, D. C., until March 19 for mechanical equipment, except elevators and lifts, for the United States post office and court house, Dayton, Ohio, in accordance with plans and specifications, copies of which may be obtained at the office of construction, Dayton, Ohio, or at the above office. Oscar Wenderoth is supervising architect.

PAULDING, OHIO.—Owing to the Town Council not being able to make satisfactory arrangements with the Auglaize Pwr. Co., of Defiance, to transmit energy to the town of Paulding, the Council has decided to rebuild the municipal electric-light plant. The plans provide for the installation of new generating machinery and new wiring system throughout. Alternating-current system will be installed. Smith & Gray, of Toledo, are engineers.

RALSTON, OKLA.—The purchase of a 60-hp steam engine to replace its gasoline engine or the erection of a transmission line to Pawnee City, a distance of 18 miles, to secure electricity from the municipal electric plant in that city, is being considered by the Ralston El. Lt. & Wtr. Wks.

TEXHOMA, OKLA.—The city of Texhoma has engaged W. M. Magruder, engineer, of Liberal, Kan., to take charge of the construction of the proposed municipal electric-light plant, bids for which will be opened Feb. 25.

GRANT'S PASS, ORE.—The Rogue River Pub. Ser. Corpn., recently organized to take over the property of the Chicago & Rogue River Co. (bankrupt), the Oregon Wtr. & Pwr. Co. and the Golden Drift Mining Co., will build two additional power plants. George E. Sanders is president of the Rogue River Pub. Ser. Corpn.

MILTON, ORE.—The City Council is considering the question of installing a new street-lighting system. The installation of 50 arc lamps is under consideration.

PORTLAND, ORE.—The Portland Ry., Lt. & Pwr. Co. has agreed to install 99 arc-lamps in the residential district. B. S. Josselyn is president.

PORTLAND, ORE.—The Rose City Park Improvement League is considering the installation of an ornamental street-lighting system on Sandy Boulevard.

PORTLAND, ORE.—The Oregon-Washington Ry. & Navigation Co. is contemplating equipping the Sullivan Gulch line from the water front to Troutdale for electrical operation.

PORTLAND, ORE.—Work will begin at once by the Portland Ry. & Lt. Co. on equipping the first section of the Mount Hood railway, from Montaville to Gresham, for electrical operation.

PRAIRIE CITY, ORE.—The plant of the Prairie Lt., Pwr. & Milling Co. was destroyed by fire recently, causing a loss of about $20,000. The town will be without electrical service until the plant is rebuilt. F. W. Peet, V. C. Belknap and R. C. Reese were owners of the plant.

TOLEDO, ORE.—The local electric-light plant has been purchased by Lewis Montgomery, of Portland. A new power station will be erected and new machinery installed. The machinery which has been used heretofore will be removed from the sawmill to the new building.

PANAMA.—Sealed proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until April 14, for furnishing and erecting coal-handling machinery and accessories for two coaling plants. Blanks and general information relating to this circular (No. 763) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

ELLWOOD CITY, PA.—The Pennsylvania Pwr. Co., a subsidiary of the Mahoning & Shenango Valley Lt. Co., is making a survey for a dam on the Shenango River near Hazel Dell.

HARRISBURG, PA.—The Harrisburg Lt. & Pwr. Co. has submitted a proposition to the City Council offering to install 52 single standard arcs, similar to those now temporarily located on Market Square, and 54 standards, carrying five-lamp clusters, similar to those temporarily placed on the Courthouse Plaza. The arc lamps will cost $98.60 each per year and the cluster lamps $91 per standard per year, making a total of $10,041. George B. Tripp is vice-president of the company.

JOHNSTOWN, PA.—Notices have been filed at the State Department at Harrisburg of the merging of 38 electric companies chartered for Blair, Indiana and Cambria Counties into the Penn Pub. Ser. Co. of Johnstown; 11 into the Central Lt., Ht. & Pwr. Co., and three into the Penn Pub. Ser. Co. All companies will operate in the vicinity of Johnstown.

PHILADELPHIA, PA.—The Philadelphia Hydro-Electric Co. is planning to increase the output of its power station at Manayunk and will install four 700-hp Morgan Smith Co. waterwheels, Lombard waterwheel governors, four 400-kw Westinghouse alternating-current generators with switchboard and six Westinghouse transformers. The company will also erect one substation to be equipped with three 50-kw rotaries, etc. S. Leonard Kent, Jr., is general manager.

GREER, S. C.—Bonds to the amount of $15,000 have been voted for the construction of an electric-light plant. John D. Wood is Mayor.

PORT ROYAL, S. C.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 15 for an ice-making and refrigerating plant at the United States Naval Disciplinary Barracks, Port Royal. The cost of the work is estimated at $6,000. H. R. Stanford is chief of bureau.

WATERTOWN, S. D.—Work will begin early in March on construction of the new service building to be erected by the Dakota Central Tel. Co. at a cost of about $20,000.

WINNER, S. D.—C. O. Cobb, of Funk, Neb., has applied to the City Council for a franchise to install and operate an electric-light system in Winner.

ARLINGTON, TENN.—The city of Arlington will award contracts on March 7 for construction of an electric-light plant and water-works system. R. C. Huston & Co., Exchange Building, Memphis, Tenn., are engineers in charge.

CHATTANOOGA, TENN.—The Chattanooga & Tennessee River Pwr. Co. will begin work at once on the construction of a steam power plant, to cost about $1,000,000. This will be operated in connection with the plant now being erected at Hale's Bar, 15 miles from Chattanooga, where a lock and dam is being built across the Tennessee River. The auxiliary plant will have an output of from 20,000 hp. to 25,000 hp. The Hale's Bar plant will develop 56,000 hp.

COLUMBIA, TENN.—A committee has been appointed to make investigations with a view of installing an ornamental street-lighting system in the business district.

KENTON, TENN.—Bids will be received by the city of Kenton until March 11 for the construction of an electric-light plant and water-works system. R. C. Huston & Co., Exchange Building, Memphis, Tenn., are engineers.

ANGLETON, TEX.—The Angleton Gin & Pwr. Co. has been granted a franchise to install an electric-light plant and ice plant. The capital stock of the company will be increased from $8,000 to $25,000.

DE LEON, TEX.—The De Leon-Gorman Lt. & Pwr. Co., recently organized, will install electric light and power plants at De Leon and Gorman. W. L. Lowe, J. T. Collie and W. M. Collie are incorporators.

FRANKSTON, TEX.—An electric light and water company has been organized by local residents for the purpose of installing an electric-light plant and water-works system in Frankston.

HEARNE, TEX.—The contract for installing a new electric light and power plant in Hearne has been awarded to Randall, Lovegrow & Wyman, of Houston.

MOULTON, TEX.—A company has been organized by residents of Moulton for the purpose of installing an electric-light and water-works plant.

YOAKUM, TEX.—The property of the Yoakum Improvement Co. has been purchased by L. L. Stephenson, of Sweetwater, including water-works system and electric-light plant, for a consideration of $100,000. Improvements will be made to the property by the new owner, involving an expenditure of more than $30,000.

COVINGTON, VA.—The Town Council has adopted a resolution authorizing the committee on street lighting to prepare in conjunction wtih W. E. Allen, attorney for the town, an ordinance providing for soliciting bids upon a franchise for electric lighting and power purposes, and to report the same to the Council for action thereupon. This action was taken at the request of the Covington Lt. & Pwr. Co. The franchise of the company expires May 20, 1918, and in order to finance proposed extensions and improvements it finds it necessary to extend the life of its franchise.

RICHMOND, VA.—Plans have been filed in the office of the building inspector for an annex to the present power house of the Richmond & Henrico Ry. Co., on Lester Street, near James River. The annex will be 106 ft. by 85 ft., built of concrete and brick, and will provide room for additional generating units to be used in connection with the proposed light and power service. The cost of the structure is placed at $35,000.

BELLINGHAM, WASH.—The Stone & Webster Corpn., of Boston, Mass., has taken over the property of the Skagit Pwr. Co. The power locations of the Skagit Pwr. Co. include two sites, one capable of developing 50,000 hp and the other 20,000 hp.

CASHMERE, WASH.—The Council has passed a resolution creating an improvement district for the lighting of Division, River and Maple Streets and Cottage, Mission and Woodring Avenues; also along the west side of Park and Long Streets.

CATHLAMET, WASH.—The Council is considering the question of establishing a municipal electric-light plant.

COLVILLE, WASH.—The Arden Tel. Co. has petitioned the County Commissioners for a franchise to erect telephone lines throughout Stevens County.

COLVILLE, WASH.—The Stevens County Pwr. & Lt. Co. is planning to extend its transmission lines to the Republic district, where, it is said, the company has closed contracts with Republic operators. Orders have been placed for equipment to increase the output of the plant near Meyer Falls and for erection of transmission lines, to cost about $200,000. The company recently closed a contract with the United Copper & Aurora Copper Companies, of Chewelah.

ELLENSBURG, WASH.—The City Council has authorized the Municipal Light Department to sell electricity to the Menashtash El. Co., recently organized by 30 West Side ranchers, for the purpose of supplpying farmers in that district with energy for lamps and motors. E. L. Butler is superintendent of the municipal electric plant.

ELMA, WASH.—The Elma Lt. & Pwr. Co. has been granted a 40-year franchise to construct an electric-light plant in this city.

NORTH YAKIMA, WASH.—The County Commissioners have granted the Pacific Pwr. & Lt. Co., of North Yakima, a franchise to erect a transmission line from its power house in the Naches Valley to Naches City. The cost of the Naches Valley project is estimated at about $500,000.

SPOKANE, WASH.—The Washington Wtr. Pwr. Co., of Spokane, contemplates extending its transmission line from Spokane to Chewelah and Republic this year. D. L. Huntington is president.

TACOMA, WASH.—A petition has been filed with Homer H. Edwards, city clerk, asking the City Council to erect standards carrying three-lamp clusters in the North End district.

BELOIT, WIS.—A movement is on foot to install an ornamental street-lighting system in the business district. It is proposed to use cluster lamps.

EAU CLAIRE, WIS.—The committee appointed by the business men has adopted the trolley-pole scheme for the ornamental street-lighting system. It is proposed to suspend arms from the trolley poles of the Chippewa Valley Ry., Lt. & Pwr. Co., each carrying four 100-cp lamps.

LA CROSSE, WIS.—The two electric plants of the La Crosse Gas & El. Co. in La Crosse are to be consolidated and one of the power stations practically rebuilt. The plans provide for the installation of two 1500-kw generators.

HOPE, B. C., CAN.—The Hope & District Pwr., Lt. & General Development Co., Ltd., has applied for a license to take 1000 cu. ft. per second of water from the Coquahalla River, to be used for power purposes.

VANCOUVER, B. C., CAN.—The Western Canada Pwr. Co. will install two additional electric generating units at its plant at Stave Falls, increasing the output to 50,000 hp. William McNeill, of Vancouver, is assistant general manager.

VICTORIA, B. C., CAN.—The city electrician has recommended an expenditure of $7,331 for equipment for the fire-alarm system.

VICTORIA, B. C., CAN.—The Hinton El. Co., of Vancouver, B. C., has secured the contract for electrical equipment for the additions to the Parliament Buildings.

VICTORIA, B. C., CAN.—The British Columbia El. Co. has asked for permission to erect transmission lines on Tenth Avenue to University. The company may construct a car line in same district. C. F. Bollschweiler is general superintendent.

WALKERVILLE, ONT., CAN.—The contract for elevators for the power plant building, owned by Walker & Sons, has been awarded to the Otis-Fenson Elevator Co., of Toronto, Can.

WATERLOO, ONT., CAN.—The Kuntz Brewery Co., of Waterloo, it is reported, will soon award contracts for additions to its power plant. Mildner & Eisen, of Detroit, Mich., are architects.

WINDSOR, ONT., CAN.—The Remington Arms-Union Metallic Cartridge Co., with main offices in New York, N. Y., has closed a deal for 100 acres in Windsor. Work will begin at once on construction of buildings, for which contracts have already been awarded to the Canadian Frost-Winchester Co., of Windsor. A power house equipped with boilers, pumping machinery, etc., will also be installed.

GUANTANAMO, CUBA.—Proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 1, for three buildings for radio station to be erected at the naval station at Guantanamo, Cuba, to cost approximately $11,000. Plans and specifications can be obtained on application to the above bureau. H. R. Stanford is chief of bureau.

New Industrial Companies

THE AMERICAN GENERATOR COMPANY, of Shelbyville, Ill., has been incorporated with a capital stock of $15,000 to manufacture machinery. The incorporators are: Clarence P. Wood, William P. Wilson and William L. Wood.

THE ELECTRIC CONSTRUCTION COMPANY, of Wheeling W. Va., has been incorporated by Edward S. Godicke, R. L. McKeley, R. B. Hunter, H. E. Hohman and William J. Burns, Jr. The company is capitalized at $10,000 and proposes to do general electric and construction work. The works and office of the company are at 47 Eleventh Street, Wheeling.

THE ELECTRIC FIRE ALARM & SIGNAL SYSTEM, of New York, N. Y., has been incorporated by Joseph Norden, Mortimer Norden and Jacob Hanover, 1993 Amsterdam Avenue, New York, N. Y. The company is capitalized at $10,000, and proposes to install and operate electric signaling systems.

THE KLIMAX ELECTRIC COMPANY, of Chicago, Ill., has been incorporated by M. J. Isaacs, James D. Woley and John D. Silber. The company is capitalized at $25,000 and proposes to do a general manufacturing and merchandising business.

THE NEW YORK TELEPHONOGRAPH CORPORATION, of New York, N. Y., has been incorporated with a capital stock of $10,000 for the purpose of manufacturing dictating talking machines and telephonographs. The incorporators are: Edward L. Langley, William M. Moore and Vere B. Reed, 34 Pine Street, New York, N. Y.

THE PERFECTION STORAGE BATTERY COMPANY, of Chicago, Ill., has been incorporated by Edward O. Briggs, Roscoe B. Higsbee and William R. Fetzer. The company is capitalized at $2,500 and proposes to manufacture and deal in electrical storage batteries and electrical accessories.

THE RAPID DISPLAY MACHINE COMPANY, of Jersey City, N. J., has been incorporated by J. Lutz, C. J. Leyas and W. Gallmeyer, of Jersey City. The company is capitalized at $100,000 and proposes to manufacture appliances for advertising and display purposes.

THE JOHN SPLITDORF CORPORATION, of New York, N. Y., has been incorporated by John Splitdorf, P. J. W. Kelly and A. L. Kull, 42 West Castile Place, New Rochelle, N. Y. The company is capitalized at $350,000 and proposes to do a general electrical and mechanical engineering business.

New Incorporations

ERVING, MASS.—The Miller's River Pwr. Co. has been incorporated with a capital stock of $1,000,000 by Fred T. Ley, Leo L. Ley and Joseph W. Johnston. The company will take over land and various water rights and easements on Miller's River in Erving, owned by F. T. Ley, and proposes to build a system of dams which will give a total fall of 400 ft. and generate from 35,000 kw to 40,000 kw. The company was organized primarily to supply power to the Amherst Pwr. Co.

TOMS RIVER, N. J.—The Central Jersey Pwr. Co. has been incorporated with a capital stock of $125,000 to operate power and light plants. The incorporators are: G. C. Van Hise, S. F. Applegate and E. R. Yoder, of Toms River.

WESTFIELD, N. Y.—The Lake Shore El. Lt. & Pwr. Co. has been incorporated with a capital stock of $25,000 by Eugene L. Falk, W. Miller Scott and Lee L. Ottaway, of Westfield.

TOLEDO, OHIO.—The Toledo Trac., Lt. & Pwr. Co. has filed articles of incorporation under the laws of the State of Maine as a reorganization of the Toledo Rys. & Lt. Co. The new company is capitalized at $17,200,000. F. J. C. Little, of Augusta, Maine, is president, and J. N. Miller, of New York, N. Y., treasurer.

SPOKANE, WASH.—The Des Chutes Pwr. Co. has been incorporated under the laws of the State of Washington. The company is capitalized at $300,000 and proposes to develop one or two water sites in central Oregon, one on the Des Chutes River and the other on the Crooked River. The plans include the erection of 80 miles of transmission lines to furnish electricity in the towns of Prineville, Redmond, Culver, Metolius and Madras, Ore. The officers are: Samuel Galland, president; W. C. Sivyer, vice-president; B. L. Sivyer, secretary and treasurer, and L. M. Simpson, general manager.

Trade Publications

GUY CLAMPS.—In a little four-page folder being distributed by W. N. Matthews & Brother, St. Louis, Mo., giant and baby boltless guy clamps are illustrated and briefly described.

BLOW-TORCHES.—Folder No. 4245 of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., deals with a "Universal" blow-torch, which is adapted to all conditions of service.

STEAM ENGINES.—The Griscom-Russell Company, 90 West Street, New York, successor to the Russell Engine Company, in its Bulletin 801 illustrates eight types of Russell engines and gives a list of specialties which it manufactures.

OZONATORS.—The Western Electric Company is sending out an eight-page folder telling about its household and universal ozonators, which are used for sterilizing and deodorizing rooms, halls, offices, etc., and in all manufacturing processes where an oxidizing agent is necessary.

ELECTRIC AUTOMOBILES.—In a booklet issued by the Electric Storage Battery Company, Philadelphia, Pa., entitled "Do You Own or Expect to Own an Electric Car?" fac-simile letters of satisfied users of "Ironclad-Exide" batteries, the latest member of the "Exide" vehicle-battery family, are given.

CONTROL APPARATUS.—In Bulletin No. 4977, issued by the General Electric Company, the Sprague-General Electric control apparatus is illustrated and described. The type dealt with is designed for use where single-car operation predominates and where a uniform acceleration is not of such importance as extreme simplicity.

RESISTANCE UNITS.—W. Dubilier, 176 North Fourth Street, Brooklyn, N. Y., describes his resistance units in a four-page folder recently issued. Some of the advantages of these units are enumerated, and an illustration and price list are shown. A leaflet on the Dubilier electric radiator is also being distributed. This little portable air heater can be attached to any electric-lighting socket.

WATER METERS.—Bulletin No. 100 of the Alberger Pump & Condenser Company, 140 Cedar Street, New York, is a large eight-page publication illustrating and describing the constructive features of Hammond water-meters. This apparatus, it is stated, has been designed for use under exacting conditions and is particularly useful in measuring condensation from engines and the supply of water to boilers.

FANS.—The D. L. Bates & Brother Company, Dayton, Ohio, is distributing its sixteen-page catalog of fans for direct current and for ceiling, desk and wall. Seven types of fans are illustrated, and a number of sectional views are shown. The new rotating ceiling fan recently brought out by this company, which can be used as a counter, desk or wall-bracket fan, is illustrated and briefly described.

ALUMINUM.—The British Aluminium Company, Ltd., of 109 Queen Victoria Street, London, has prepared a booklet setting forth the leading properties of aluminum and the various forms in which the company supplies it. The booklet is compiled in pocket form and is of particular use to electrical engineers, designers, draftsmen, etc., as they will find full information regarding aluminum in all its forms of rods, wire, bars and strips, sheets, strands, cables, tubes and aluminum alloys. It also contains hints on the working of aluminum.

GENERAL ILLUMINATION.—The engineering department of the National Electric Lamp Association, Cleveland, Ohio, has issued in four-page form a chart designed to facilitate the solution of problems in general illumination. Given the intensity of illumination required, the color of the walls and the dimensions of the space to be lighted, by referring to the chart one is able to select the most desirable size of lamp and the spacing of units to give satisfactory results. This chart will be found a convenience by those who have occasion to do specification work in illumination.

"ELECTRON."—The Central Electric Company, of Chicago, has issued the first number of a publication bearing the title *Electron*. Mr. George A. McKinlock, president of the company, says the name was chosen because "an electron is the basis of electrical power; it is thought to be the primordial thing out of which all matter is built up." The publication contains several articles of interest in its thirteen reading pages. One is a description of an installation of "Alexalite" fixtures in a new office building. With a cover in colors the little magazine presents an attractive appearance. Mr. A. M. Minnick is the editor.

Business Notes

FORBES & McCORMICK.—Messrs. I. McNeil Forbes and B. T. McCormick have opened offices in the New Birks Building, Montreal, Can., as consulting and supervising engineers.

W. N. MATTHEWS & BROTHER.—In our issue for Feb. 15 we stated that Mr. John L. Fay had become identified with W. N. Matthews & Brother as "sales manager." We should have stated that he had been appointed "sales engineer."

FARGO ENGINEERING COMPANY.—Messrs. William G. Fargo and R. G. England have organized the Fargo Engineering Company, Jackson, Mich., which will specialize in the design of hydroelectric plants and reports upon hydraulic properties.

WAGNER ELECTRIC MANUFACTURING COMPANY.—The Wagner Electric Manufacturing Company, of St. Louis, has moved its Buffalo office to 802 Electric Building, where Mr. Lewis G. Bassett continues in charge, as at the former location.

HEMMING MANUFACTURING COMPANY.—A branch office has been opened in Suite 1654, Monadnock Block, Chicago, by the Hemming Manufacturing Company, Garfield, N. J. Mr. B. A. Appleton, a graduate of Stevens Institute, will be the company's sales engineer for the Western territory.

LOCKWOOD, GREENE & COMPANY, of Boston, have appointed Mr. Leonard Goodwin, until recently in the home office, manager of the Chicago branch, with headquarters in the First National Bank Building. Mr. Harold V. Coes, formerly of the latter office, has been transferred to Boston to take charge of special work.

W. N. MATTHEWS & BROTHER.—The New York office of W. N. Matthews & Brother has been moved from 227 Fulton Street to 50 Church Street. The office will continue to be under the charge of Mr. Warren M. Heim, whose territory extends from Maine to North Carolina, and from the Atlantic to Harrisburg and Syracuse on the west.

THE PACIFIC STATES ELECTRIC COMPANY has recently completed its six-story electrical supply house between First and Second Streets on Mission and Minna Streets, San Francisco, Cal. The building contains offices, stock rooms and display rooms, and is provided throughout with elevators, lifts, automatic tubes, private telephones, etc., to facilitate the rapid and economical handling of electrical appliances.

THE CLEVELAND ICE MACHINE & MANUFACTURING COMPANY has increased its capital stock to $100,000, changed its name from the Cleveland Ice Machine Company, purchased the plant of the Brown-Cochran Company, at Lorain, Ohio, and has moved its factory to that city. The company owns a well-equipped building and is manufacturing refrigerating plants, oil, gas and gasoline engines and doing other machine work and business of that character.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEB. 11, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,052,449. BATTERY BOX; C. W. Beck, Rockville Center, N. Y. App. filed April 27, 1908. For automobile footboards, etc.

1,052,478. VARIABLE-SPEED ALTERNATING-CURRENT MOTOR. M. M. Goldberg, Ithaca, N. Y. App. filed March 4, 1912. Torqueless frequency transformer and induction motor.

1,052,488. ELECTRIC LOCK; C. Legrand and A. Armel, Paris, France. App. filed July 26, 1911. For railway cars, etc.

1,052,490. ELECTRIC WELDING TOOL; C. A. Linden and C. A. Carlson, Jamestown, N. Y. App. filed Oct. 6, 1911. Hand tool with spaced wheel electrodes.

1,052,491. ELECTRIC WELDING MACHINE; C. A. Linden and C. A. Carlson, Jamestown, N. Y. App. filed March 19, 1912. Stationary wheel and electrodes for welding tubes, etc.

1,052,513. TELEGRAPH SYSTEM; E. Pope, Quebec, Canada. App. filed June 25, 1910. Continuous stream of automatic alternations operating polar relays.

1,052,522. ELECTRIC HAIRBRUSH; V. Sence, New York, N. Y. App. filed May 14, 1912. Magneto attachment.

1,052,528. INDUCTIVE CONTROLLING APPARATUS; A. Sundh, Yonkers, N. Y. App. filed March 1, 1910. Manually operated master switch system for elevators, etc.

1,052,535. FIELD MAGNET; E. Volkers, Berlin, Germany. App. filed March 27, 1911. Interconnected pole pieces.

1,052,538. ELECTRIC ALARM SYSTEM; A. U. and S. E. Weaver, Santa Anna, Tex. App. filed Feb. 3, 1912. Selenium cell circuit-closer.

1,052,548. TELEGRAPH TRANSMITTER; J. E. Wright, New York, N. Y. App. filed Feb. 28, 1911. Page-printing machine. (Improvement on patent No. 954,489.)

1,052,550. ELECTRICAL SWITCH; M. F. Young, Pueblo, Col. App. filed April 19, 1911. Controlled by the motorman.

1,052,555. METER-SERVICE LEAD CONNECTION FOR THREE-WIRE SYSTEMS; P. H. Bacon, New York, N. Y. App. filed Nov. 10, 1911. To prevent the theft of electricity.

1,052,583. PROTECTING DEVICE FOR VAPOR APPARATUS; P. C. Hewitt, New York, N. Y. App. filed Jan. 11, 1906. X-shaped container.

1,052,584. COOLING DEVICE FOR VAPOR ELECTRIC APPARATUS; P. C. Hewitt, Ringwood Manor, N. J. App. filed July 7, 1904. Liquid circulation through the container.

1,052,586. TROLLEY STAND; H. Holland, Cleveland, Ohio. App. filed Dec. 19, 1910. Low-setting spring type.

1,052,587. SYSTEM OF ELECTRICAL CONTROL; J. D. Ihlder, New York, N. Y. App. filed June 12, 1908. Ammunition hoist for gun service, etc.

1,052,595. CIRCUIT-BREAKER; R. C. Lanphier, Springfield, Ill. App. filed March 22, 1911. Solenoid type.

1,052,608. METER TESTING CUT-OUT; A. V. A. McHarg, New York, N. Y. App. filed May 31, 1912. Switch-gang and operating lever.

1,052,642. ELECTRIC OUTLET BOX; A. I. Appleton, Chicago, Ill. App filed June 11, 1909. Detachable outlet cover.

1,052,674. THERMOSTAT; L. A. Lindsey, Armuchee, Ga. App. filed Dec. 14, 1911. Operates on quick or excessive change of temperature only.

1,052,717. ROTARY TRANSFORMER; E. M. Fraser, Yonkers, N. Y. App. filed April 28, 1911. Controlled by a rotation without the introduction of ohmic resistance.

1,052,724. ELECTRIC BURGLAR-ALARM DEVICE; R. C. Jones, Brooklyn, N. Y. App. filed May 13, 1912. Window switch.

1,052,727. PROCESS OF EXTRACTING ALUMINUM FROM ITS ORES; A. Kissock, Golden, Col. App. filed June 6, 1911, The ore is heated with carbon and sulphur compound.

1,052,730. ELECTRICAL HEATING UNIT; F. Kuhn and F. E. Shailor, Detroit, Mich. App. filed Oct. 16, 1909. Flat-plate construction for sadirons, etc.

1,052,753. TRANSFORMER FOR ELECTRIC METAL-WORKING APPARATUS; A. F. Rietzel, Charlestown, R. I. App. filed Jan. 12, 1910. Single transformer for multiple welding.

1,052,787. CLAMP FOR ELECTRIC METAL-WORKING APPARATUS; G. E. Barstow, Lynn, Mass. App. filed June 10, 1911. Variable pressure for welding.

1,052,816. THERMOSTAT; W. S. Hadaway, Jr., East Orange, N. J. App. filed May 1, 1909. Automatic regulator for electric-heating device.

1,052,820. PROCESS OF BRAZING TUBING; H. Higgin, Newport, Ky. App. filed March 14, 1910. Passed between pressure and heating rolls.

1,052,834. AIR HEATER; J. Lawrence, New York, N. Y. App. filed Dec. 16, 1909. Accumulator system for house heating, etc.

1,052,843. ELECTRICAL-RESISTANCE DEVICE; E. J. Ovington, Los Angeles, Cal. App. filed April 26, 1910. Immersion heating device.

1,052,849. SYSTEM OF RADIOTELEPHONY; W. Schleemilch and P. F. Pichon, Berlin, Germany. App. filed Nov. 29, 1907. Continuous oscillations of constant amplitude.

1,052,851. PROCESS OF TREATING WOOD SEPARATORS FOR STORAGE BATTERIES; J. M. Skinner, Philadelphia, Pa. App. filed March 13, 1912. Immersion in nutrium sodium bisulphate.

1,052,891. CURRENT-CONTROLLING DEVICE; L. O. Corell, Kalamazoo, Mich. App. filed April 17, 1911. Foot-operated switch for electric lights, etc.

1,052,894. ELECTRICALLY HEATED STOVE; A. S. Cubitt, Rugby, England. App. filed Oct. 21, 1911. Closing the door opens the controlling switch.

1,052,903. ELECTRIC SWITCH OR CUT-OUT; P. Druseidt, Remscheid, Germany. App. filed April 28, 1910. Push-button type.

1,052,920. SWITCH; H. D. Hinckley, Hartford, Conn. App. filed Oct. 14, 1911. Quick-break straight-line movement.

1,052,932. ELECTRIC AUTOMATIC ALARM; W. Maginot, Hammond, Ind. App. filed May 8, 1912. Temperature alarm for incubators.

1,052,950. FUSE; J. H. Palmer, Chicago, Ill. App. filed May 24, 1912. Cartridge type with replaceable fuse.

1,052,975. SWITCH-JAW; C. B. Shoeman, Wilkinsburg, Pa. App. filed Sept. 25, 1912. Knife switch jaw anchor.

1,052,987. THERMOSTATIC SWITCH; A. E. Weed, Berkeley, Cal. App. filed March 7, 1911. For controlling current through a resistance coil.

1,052,997. ELECTRIC HEATER; W. Barstow, San Francisco, Cal. App. filed May 21, 1912. Tubular air heater.

1,052,998. AUTOMATIC ELECTRIC HEATER; L. S. Besley, Salt Lake City, Utah. App. filed Sept. 26, 1911. Tubular bed heater, etc.

1,053,006. TROLLEY-HEAD; C. H. Buck, Cleveland, Tenn. App. filed Jan 13, 1912. Joint and pressure device.

1,053,022. ELECTRIC SWITCH; J. M. S. Fontecha, Mexico, Mexico. App. filed Feb. 26, 1912. Rheostat type.

1,053.038. SIGNALING SYSTEM; J. M. Johnson, Ishpeming, Mich. App. filed Feb. 23, 1908. Mine hoist, etc.

1,053,042. HIGH-SPEED TELEGRAPH SYSTEM; C. Kinsley, Chicago, Ill. App. filed Aug 30, 1909. Segmental letter printing.

1,053,048. SELECTIVE TELEPHONE-CALL SYSTEM; O. N. Lindsey, Senatobia, Tenn. App. filed Aug 20, 1909. Successive action of cut-outs.

1,053,062. MOTOR CAR; A. Palmros, Columbus, Ohio. App. filed Nov. 22, 1900. Two separate motor-driven trucks pivotally connected with the body.

1,053,076. ELECTRICAL WATER HEATER; F. Walker, Los Angeles, Cal. App. filed Sept. 10, 1906. Construction to prevent electrolysis.

1,053,096. ELECTRIC FUSE AND CUT-OUT; I. S. Johnston, Utica, N. Y. App. filed Feb. 28, 1910. Manual and automatic renewal.

1,053,098. SYSTEM FOR THE TRANSMISSION OF ELECTRICAL ENERGY; C. D. Lanning, Boston, Mass. App. filed Dec. 26, 1905. The reinforcing of telephonic alternating currents by super-position.

1,053,107. APPARATUS FOR GENERATING ALTERNATING CURRENTS; J. L. Milton, Chicago, Ill. App. filed Jan. 30, 1909. For gas-engine spark ignition.

1,053,110. APPARATUS FOR REGULATING THE PRESSURE IN STEP TRANSFORMERS; R. Richter, Grunau, Germany. App. filed Sept. 21, 1911. Induction regulator.

1,053,111. ELECTRIC BELL; W. E. Russell, Danbury, Conn. App. filed April 28, 1909. Inclosed type of mechanism.

13,526 (reissue). INSULATOR; W. H. Kempton, Mansfield, Ohio. App. filed Sept. 22, 1909. Strain insulator. (Original patent No. 904,069, Nov. 17, 1908.)

13,529 (reissue). INSULATING BUSHING; C. H. Thordarson, Chicago, Ill. App. filed Nov. 1, 1911. For electric wiring. (Original patent No. 962,726, June 28, 1910.)

13,530 (reissue). ELECTRIC WELDING MACHINE; F. Warren, Cincinnati, Ohio. App. filed Jan. 9, 1913. Adjustable and movable dies. (Original patent No. 1,046,240, Dec, 3, 1912.)